DOCUMENT RESUME

ED 029 489 24 EM 006 096

By-Parkman, Ralph
Cybernation and Man--A Course Development Project. Final Report.
San Jose State Coll., Calif. School of Engineering.
Spons Agency-Office of Education (DHEW), Washington, D.C. Bureau of Research.
Bureau No-BR-6-8439
Pub Date 28 Feb 67
Note-190p.
EDRS Price MF-$0.75 HC-$9.60
Descriptors-Automation, Computers, *Course Descriptions, *Cybernetics, Economic Progress, Human Engineering, Human Resources, Instructional Materials, Library Materials, *Man Machine Systems, *Science Courses, Systems Analysis, Systems Development, *Technological Advancement, Technology
Identifiers-The Knowes Report

An inter-disciplinary course entitled "Cybernation and Man," developed by the School of Engineering at San Jose State College, tries to evaluate the many problems posed to man by the expansion of his technology. It is contended in the course that the most effective approach to control of complex social phenomena within a technological world comes from the pragmatic methods of engineering technology rather than the more abstract theories of the basic scientist. Topics for the one-semester, three-unit course cover the history of cybernetic machines, simple systems theory, and the broad range of effects of cybernation on labor, economics, industry, and other aspects of society. Each lecture topic is accompanied by full audio- and videotape references, film references, and a bibliography of other materials from many sources for use supplementary to the course. The appendices include a course syllabus, a description of field trips, and a number of student papers. (BB)

ED029489

FINAL REPORT

CYBERNATION AND MAN - A COURSE DEVELOPMENT PROJECT

TO

THE DIVISION OF HIGHER EDUCATION RESEARCH
U. S. OFFICE OF EDUCATION

BY

RALPH PARKMAN

February 28, 1967

SCHOOL OF ENGINEERING
SAN JOSE STATE COLLEGE
SAN JOSE, CALIFORNIA 95114

EM006096

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY.

PREFACE

Cybernation and Man is the product of the contributions of many people at San Jose State College and elsewhere. The original concept of a course of this kind is that of Dean Norman O. Gunderson, and it is his continued encouragement which has allowed it to flourish. Members of the faculty and Staff of the School of Engineering who have cooperated in the planning and teaching of the course include E. A. Dionne, R. P. Loomba, R. Popkin and R. Swenson. S.P.R. Charter has acted as consultant to this project, as well as teacher. Our whole effort would be poorer without the constant stimulus of his seminal ideas. A debt of gratitude is also due to the many guest lecturers who have contributed so much to the class sessions. A list of their names appears in the Appendix.

Students who have assisted in the preparation of materials for the report were Emmy Lou Miller, Mary A. Keesling and James Lewis. Their efforts are appreciated.

The support of the U. S. Office of Education, and the help of Dr. Clarence Lindquist of the Division of Higher Education Research is acknowledged with thanks.

San Jose, California
February, 1967

Ralph Parkman, Professor
Materials Science

TABLE OF CONTENTS

Page

I. INTRODUCTION 1

II. OBJECTIVES AND NATURE OF COURSE 3

III. SUMMARIES OF TYPICAL LECTURE AND DISCUSSION TOPICS 6

- A. History of Man-Machine Systems 7
- B. Social and Engineering Systems 10
- C. Cybernetics and Communication 14
- D. Basic Factors No. 1 - Industry and Labor 17
- E. Basic Factors No. 2 - Cybernation and Economics 22
- F. Basic Factors No. 3 - Concerns of Social Scientist 25
- G. Basic Factors No. 4 - Cybernation and the Professions . . . 29
- H. Basic Factors No. 5 - The Computer and the Mind: Artificial Intelligence 34
- I. Basic Factors No. 6 - Cybernation and the Underdeveloped Areas. 40
- J. Basic Factors No. 7 - Cybernation and the Problem of Leisure 44
- K. Basic Factors No. 8 - Cybernation and Education 49
- L. Basic Factors No. 9 - Cybernation and Human Values 54
- M. Additional Discussion Topics 57

IV. FIELD TRIPS 58

V. COMPUTER ACTIVITY PERIODS 65

VI. AUDIOTAPE REFERENCES 66

VII. FILM AND VIDEOTAPE REFERENCES 74

(continued on next page)

TABLE OF CONTENTS (Cont'd.)

Page

VIII. BIBLIOGRAPHY 99

APPENDIX

i Sample Syllabus - Fall 1966. A-3
ii List of Guest Lecturers A-15
iii Examples of Student Papers A-19
iv Typical Lecture Outlines A-51

I. INTRODUCTION

This report describes a development project for a course titled Cybernation and Man (CAM) which is being offered in the School of Engineering at San Jose State College. It is an inter-disciplinary effort to examine and evaluate the multiple and changing problems confronting man in a technological age.

Cybernation and Man (Eng 100) was first offered in the Spring semester of 1965; it is now an accredited course in the School of Engineering. Later that year a brochure (herein attached) describing the objectives of the course was prepared and sent to colleagues at a number of institutions. There came, as a result, many requests for further information and for assistance in setting up similar programs. The U. S. Office of Education agreed to sponsor a short-term study from July 22, 1966 to February 28, 1967 to develop Course resource materials for distribution. The report is the result of that project.

The stated objectives were the following:

1) The evaluating and listing of audiotapes and films produced by other organizations.

2) The editing and preparing of tapes from our own class sessions for possible loan or sale at the approximate cost of production and distribution.

3) The preparing of an extensive bibliography.

4) The preparing of summaries and outlines of some of the course lectures.

5) The distribution of the above to interested institutions and individuals.

II. OBJECTIVES AND THE NATURE OF THE COURSE

Cybernation and Man (CAM) was originally conceived as an interdisciplinary attempt to broaden and deepen understanding and communication between and among the multiple factors comprising our technological world; more directly, between engineering on the one hand, and the humanities, the social and the physical sciences on the other.

There is now general growing acceptance that cybernation-automation* is causing, and will accelerate the causing, of profound changes throughout all spectra of society. Cybernation and Man (CAM) contends that if there is an effective approach to the awareness and control of complex social phenomena within a technological world which may even precede complete understanding of these phenomena, such an approach is more likely to come from the pragmatic methods often associated with engineering technology rather than from the precise, yet in some ways more elusive, theories of the basic scientist.

The need for an interdisciplinary course of the nature of CAM is indicated by the sheer volume of books and articles now being published which relate to the various ways in which man and machine (especially the computer) interact. Many humanists warn of the enveloping threat, to the individual and the group, of the computer; many engineers hail its utility and promise; many theologians feel that there may be fundamental moral implications associated with its expanding use; many behaviourists are convinced that the processes of science and technology coupled with the computer offer the best opportunity to understand the complexities of society, but others do not agree. And so it goes. . . . However, there is general acceptance that cybernation* is destined to cause profound social changes throughout the world.

---

* As defined by Dr. Donald Michael, "cybernation" means the coupling of the computer to automatic production systems. For the purposes of the course and for economy of expression the meaning of the word has been broadened to include aspects of the use of the computer and other machines in the systematic manner prescribed by modern science and technology.

To learn how to explore the different points of view, while providing a synthesis of those elements in the scholarly fields concerned with man-machine relationships, has been the primary objective of the course from the start. The approach has been founded on the conviction that the technological studies offer a useful basis for achieving this goal. Technology and its devices are common to the experience of young individuals in all disciplines. Thus there is an existing incentive for students to pursue formal course work which confronts scientists and engineers with the need to consider the social-individual effects of their mechanisms, and at the same time clarifies for students with non-technical training certain ideas and aims of technology which are often misunderstood.

Scholars and practicing professionals from a number of fields have been brought together in this course under Engineering sponsorship to question and be questioned by students from many departments. In the time available - two lecture hours and one 2-to-3 hours activity period each week for one semester - a survey-type approach is required, but the upper division and graduate students who take the course tend to bring with them background of sufficient depth and range that many individual topics can be explored adequately.

---

* See Page 3

The course pattern is flexible, but not haphazard. The hour sessions include formal lectures, but speakers are always encouraged to allow ample time for questions. It is most important to fit the guest lecturer into the continuity of the course. A necessary function of the course coordinator has been to brief him carefully on the aims of the course, the scope of the students' reading assignments and the discussions in previous sessions, and the kinds of topics within his interest and competence which would be a contribution to the current discussion topic.

At least four 3-hour sessions are set aside for examination of student papers on special topics - the class being split into 15 member discussion groups each with its own faculty discussion leader. Four of five other 3-hour periods are designated as computer sessions. The objective here is to try to develop a feeling for the power and potential of the computer, and to provide a modest programming competence for those without previous computer experience. Field trips to industries and computer installations in the San Jose Area are arranged to offer an opportunity for students to see to what extent the machine is capable of replacing man, and to show, as well, how the computer can generate new kinds of work and new approaches to problems in industry and society.

III. TYPICAL LECTURE AND DISCUSSION TOPICS

Each semester that the course has been taught, there have been some changes in the manner of the approach to the major topics. Different participants are invited, field trips are taken to other points of interest than before, and new subjects are often included.

In general however, it has been found desirable first to follow a pattern which introduces students to the general nature of the complexities of a cybernated era, and then examines how some of the problems are rooted in technological history. Next they are exposed to elementary concepts of cybernetics and the systems approach to problem solving. Following this, some of the basic concerns of various groups are explored. The industrial worker and his employer, the psychologist, the political scientist, the public administrator, the human ecologist, the theologian, the artist, the engineer and physical scientist - all of these and others - have an intimate involvement with cybernation. The studying of their special concerns in detail offers fresh viewpoints to the students. Some have mentioned that this helps create a synthesis of ideas which were previously disconnected in their understanding.

In the following sections, some of the major ideas which have been discussed in class are summarized under the separate headings.

III A. HISTORY OF MAN-MACHINE SYSTEMS

Much of human endeavor has been related to systems involving both man and machines, and yet it is only within recent years that the history of technology has begun to receive the amount of careful, scholarly attention that it deserves. There are now, however, a number of suitable references describing significant historical developments in technology which can be used as background for lectures and discussions.

Since Cybernation and Man attempts to survey the entire range of man's relation to his machine-influenced environment, only a limited period of time can be devoted to this interesting topic. In two sessions one can trace the pattern of the evolving utility and complexity of machines, as well as of man's increasing reliance upon them.

The earliest mechanical devices were simple tools, permitting man to extend, to an impressive degree, his capacities for performing physical labor. They were, however, inherently limited by the fact that the primary energy source was man himself, with some help from water and the wind. The development of new, controllable sources of energy, (e.g., the use of steam and electricity in the late 18th and 19th centuries) vastly extended man's capabilities for productive physical labor. The trend was accelerated, too, by the innovation of the manufacturing method of interchangeable parts. Once parts were capable of being machined to close dimensional tolerances, they could be fitted together randomly in the final assembly. Now it developed that many workers skilled in only one phase of the manufacturing process began to replace the versatile craftsman.

Since World War II, the need for men to perform monotonous mental tasks is being reduced by computers. These devices, coupled with automatic processing machinery, can result in systems of striking productive capacity.

The idea of the calculating machine has mechanical antecedents extending as far back as the 17th Century when the French mathematical philosophers, Pascal and Leibnitz invented devices which could add. In fact, Leibnitz' machine multiplied by repeated addition, but was mechanically unreliable. It was Charles Babbage, an Englishman of the 19th Century, who anticipated many of the features of the modern computer. Unfortunately, his attempt to make a purely mechanical creation of such complexity was predestined to failure because of the inadequate manufacturing methods of the period. In the 20th Century many scientists and engineers have contributed to the development of the electronic computer, but probably the two most fundamental advances which have permitted its evolution to the present form have been Shannon's idea that there was a close relationship between symbolic logic and electrical network theory; and Shockley's transistor which has permitted the manufacture of computers of manageable size and dependability.

Two class lectures tracing out these historical developments in substantially greater detail are outlined in the appendix, and are also available on tape as part of the Cybernation and Man series, CAM-2 - "History of Man-Machine Systems." There are also tapes relevant to this topic which have been produced by the Center for the Study of Democratic Institutions, Santa Barbara, California. All tapes, films, and books referred to in the summaries of the individual topics are more completely described in primary listings appearing later in the report.

Useful references for this unit are:

Tape References

CAM-2, "History of Man-Machine Systems"
CSDI-310, "The Inanimate Slaves"
CSDI-311, "The Machine Universe"
CSDI-312, "The Working Man"

Film References

"Universe of Numbers," N.E.T., Indiana University
"Finger Counting by Machine," U.S. Military Academy, I.T.V. Center
"How to Get 100 Frenchmen to Work: " " " "

Articles and Books

Bernstein, J., The Analytical Engine, Random House, 1964
Klemm, F., A History of Western Technology, M.I.T. Press, Cambridge, 1964
Leikind, Morris C., "The History of Technology" in The Evolving Society ed. Alice Mary Hilton, Inst. for Cybercultural Research, New York, 1965
Mumford, Lewis, Technics and Civilization, Harcourt, Brace & World, New York, 1963
Technology and Culture, a quarterly published for the Society for the History of Technology by the University of Chicago Press.

Additional helpful references are to be found in the main bibliography.

III B. SOCIAL AND ENGINEERING SYSTEMS

It has become almost a commonplace to talk about the explosion of scientific and engineering knowledge, but it is not trivial to observe that this proliferation has immense built-in hazards if there is a continuing lag in the ability of society to cope with changes, many of which have been induced by the new knowledge.

The feeding of the hungry majority, the keeping of the peace, and the striving to prevent a further deterioration of our environment are just a few of the tasks confronting us. There is no certainty that they can be dealt with, but it is a near certainty that they will not yield to anything less than a systematic attack using the available tools of the social and physical sciences and engineering. The engineer can and ought to play a larger role than he has before in these affairs; because no study of large social systems today can ignore the technological factor. He has a tradition of orderly, rational approaches to the solution of physical problems which have often been predictably effective. The engineering method requires, among other things, accurate and current data. It is only with the development of the modern computer that it has been possible to make available the huge amounts of information which would be required to attack social problems perhaps orders of magnitude more complex than those to which the engineer is accustomed.

Adequate information is a necessary but insufficient prerequisite to social problem-solving. Only a naive engineer or scientist could believe that quantitative information and technique alone would suffice. An effective attack also needs the insights of participants from the social and humanistic studies; and generalists as well as specialists. The so-called systems approach partakes of all of these elements.

The whole concept of systems analysis applied to social problem solving is flourishing in government and business circles. The extent to which it can be examined in college course-work is, of course, a function of the homogeneity of academic backgrounds represented in the class. Some branches of engineering and certain other disciplines have a strong commitment to many kinds of planning and programming which require a broad mathematical base. In a course such as Cybernation and Man where the majority of enrolled students have been undergraduates from diverse non-technical major fields, the brief introduction to general systems studies must not be too detailed. On the other hand to say that these methods cannot be surveyed at all without the requisite mathematics is to ignore the compelling challenge to technically trained people to make themselves understood outside their own small circles. It is also a fact that once programs of sufficient subtlety are produced by mathematicians, it will not require a high order of mathematical skill on the part of others to use them in many kinds of systems.

After terminology has been defined, it is possible as a class exercise to look at certain simple systems and see how the various elements are integrated.

This past semester the example of the construction of a small hospital in an underdeveloped area with specified characteristics was undertaken. Enough technical and social elements can be introduced in the descriptive treatment of a project of this kind to maintain the interest of students with an engineering orientation, no less than the others.

There appears to be a place in higher education for greatly expanded general curricular developments emphasizing systems studies. Dean Norman O. Gunderson of the School of Engineering at San Jose State College has proposed such a program in a paper which is included among the references in the following list.

Tape References

CSDI-303 - "Systems Science and Social Innovation," Discussant, Dr. Robert Arnold

Film References

"One Step Behind - One Step Ahead" - Description of computerized system for crime prevention and detection. Systems Development Corporation.

Articles and Books

Bellman, Richard, "Dynamic Programming," *Science,* Vol. 53, No. 3731, July 1, 1966, p. 34

Ellis, David O. and Ludwig, Fred J., *Systems Philosophy*, Prentice-Hall, 1964

Forrester, J. W., *Industrial Dynamics,* J. Wiley and Sons, New York, 1961

Gunderson, Norman O., "Cybernation and Man in the Engineering Curriculum," *Journal of Eng'r. Education,* Vol. 56, No. 10, June '66, p. 362

Helmer, O., Social Technology, Basic Books, New York, 1966

Lessing, L. "Where the Industries of the Seventies Will Come From," Fortune, Vol. LXXV, No. 1, Jan., 1967, p. 96

McCarthy, J., "Information," Scientific American, Vol. 215, No. 3, Sept. 1966, p. 65

Society of General Systems Research, Yearbook, Ann Arbor, Michigan, Vol. 1 - 1956

Strachey, C., "Systems Analysis and Programming," Scientific American, Vol. 215, No. 3, Sept. 1966, p. 112

Ways, M., "The Road to 1977," Fortune, Vol. LXXV, No. 1, Jan. 1967, p. 96

Other references will be found in the primary bibliography.

III C. CYBERNETICS AND COMMUNICATION

Cybernation was defined in a previous section as the coupling of the computer to automatic production methods. The essence of cybernation - and one of the fundamental concepts in this course - is the idea that the utilizing of energy for useful tasks and the handling of information, two important functions of human beings are theoretically replaceable by non-human agencies.

This notion is also implicit in the theory of cybernetics, a scheme of thinking proposed by the eminent mathematician, Norbert Wiener. Wiener called cybernetics "the study of control and communication in the animal and the machine." It was his idea that self-regulating machines show a characteristic behavior pattern which can be described in common mathematical terms with reasonable precision. He was intrigued by the possibility of applying the theories of automatic controls in machines to the understanding of relationships in organic systems. In his book, The Human Use of Human Beings, which was a popularization of his earlier and more technical Cybernetics, Wiener wrote, " . . . society can only be understood through a study of the messages and communication facilities that belong to it; and . . . in the future development of these messages and communication facilities, messages between man and machines, between machines and man and between machine and machine are destined to play an ever-increasing part."

Engineers and scientists are capable of analyzing and designing mechanical and electrical systems which control themselves by the "closed-loop feedback" principle. That is to say, a departure in the pattern of operation from a prescribed norm will generate a measurable signal to bring the system back within the control limits. There is conclusive evidence to suggest that natural organisms can regulate themselves in a similar fashion.

From the standpoint of cybernetics, the political and economic structure of this country is a hugely complex system which can be thought of as a type of machine for handling information. Unlike the deterministic systems of the engineer this one is probabilistic - its component parts interact in a way which cannot be predicted precisely. Philosophically, it is interesting to contemplate whether such a probabilistic system may someday turn out to be, in fact, deterministic given the availability of sufficient information. The time has not yet come to find an answer to this kind of question. The theoretical difficulties still loom too large.

The study of information theory in a system is designed to clarify understanding of the processes of stimulus and discriminatory response in a system, and to try to determine how accurately information can be passed between elements of a system despite disturbing effects. Such modest successes as cybernetic principles have had thus far in other than purely electrical or mechanical systems are largely in the biological studies. There is a good deal of evidence to suggest that the cybernetic approach will be a fruitful one for biology.

Some of the primary sources for information about cybernetics tend to be highly technical; others can readily be understood by the intelligent non-scientist. Examples of both kinds of sources are given here.

Tapes of three Cybernation and Man class lectures discuss automatic controls and basic elements of communications systems. They are CAM-3, Side No. 2 and CAM-4. (See tape bibliography.) One interesting, though now somewhat out of date film which features Norbert Wiener, and Dr. Claude Shannon (one of the pioneers of information theory) is Automatic Machines, available from McGraw-Hill. (See film bibliography.) For audiences with some interest in science, the film Introduction to Feedback produced by IBM Corporation may be useful.

Articles and Books

Beer, S., Cybernetics and Management, Science Editions, John Wiley & Sons, New York 1964

Broadbent, D. E. "Information Processing in the Nervous System," Science, Vol. 150, Oct. 22, 1965, p. 457

Gilbert, E. N., "Information Theory After 18 Years," Science, Vol. 152, April 15, 1966, p. 320

Hilton, Alice Mary, Logic, Computing Machines and Automation, Sparta Books, 1963

Mackay, Donald, "What is Cybernetics?" Discovery, Vol. XXIII, No. 10, Oct. 1962, p. 13

Pierce, J. R., Symbols, Signals and Noise, Harper, N. Y., 1961

Wiener, N., The Human Use of Human Beings, Doubleday, Garden City, N. Y., 1954

III D. BASIC FACTORS #1 - INDUSTRY AND LABOR

Will the near future see a society in which critically large numbers of workers are displaced by the machine? The history of technology tells us that this question has troubled members of the working classes almost from the beginnings of the Industrial Revolution - that is to say, from the latter half of the 18th Century when the hobbles were first removed from methods of producing goods for mass consumption. Their fear of the workhouse was sharply portrayed by Dickens and other later literary figures.

Yet it is demonstrably a fact that over the last 200 years mass production methods have brought higher levels of affluence to Western nations; and despite cyclical fluctuations there has been no unambiguous steady trend towards larger and larger percentages of working age adults being permanently put out to work. Has the recent advent of cybernation produced a qualitative change in this picture? Does the pace of worker displacement accelerate with the development of machines which can perform tasks involving mental as well as physical labor? There are no conclusive answers.

San Jose State College is located in an area where there is a variety of industries, and so we have been able to obtain competent spokesmen to present the prevalent views of both labor and management on these questions. There is obviously no consensus, even among representatives of a single camp, but from their ideas and those found in the relevant literature, we can arrive at a reasonable balanced assessment.

One fact is that any analysis of the problem must recognize that there is a technological and an economic track - they often overlap but they are not identical in their scope or in their effects. Stating it in an over-simplified way, technology is confident, single-minded and often heedless. It takes the position that what is mechanically and scientifically conceivable can be constructed and ought to be if there is any indication that the result will represent a change which will be accepted and which will increase productivity. Economics (or business if you will) tends to be more cautious. It will make changes after considering the interplay of many factors if there is a reasonable indication that the changes will cause profits to improve.

Another fact is that statistics on unemployment even when they are available are often misleading. Aside from the artificial stimulus to employment of declared and undeclared wars, official methods of calculating unemployment rates consider a person employed only if he has sought a job recently, nor do they consider him unemployed if he is able to find part-time jobs. What we can say and come reasonably close to the mark would be something like the following.

Our present technology is capable of designing and constructing, very quickly, automated and cybernated production and data processing systems which can eliminate hundreds of thousands of jobs of a repetitive nature. Some such displacements are already occurring to a disturbing degree. In the spring of 1966, according to Newsweek magazine of March 7, 20,000 Delta Negro farm workers were laid off. Machines were able to pick 95% of the year's cotton crop compared to 69% in 1964.

The actual pace of cybernation nationally is a good deal slower than many suggest. Charles Silberman wrote in the January, 1965 issue of Fortune that "Ten years after computers started coming into use, no fully automated process exists for any major industry in the United States, nor is there any in prospect for the immediate future." This kind of statement, too, can be somewhat misleading, however. For one thing it does not fully consider so-called minor industries such as bakeries which are beginning to move rapidly to nearly complete automation. For another, the statement appears to refer to industries whose products are tangible goods, whereas probably the most dramatic thrust of cybernation is in the handling of information. Nevertheless, it is true that cybernation, as it eliminates some jobs, also creates new ones which never existed before. It is also true that there are many non-repetitive types of jobs which will not be cybernated for a long time to come. As soon as it becomes apparent, though, that the human worker must be replaced by a machine in order to meet the competition and make a profit, it is nearly inevitable under our system that a change will be made. Each time a labor union obtains a wage increase for its workers in a routinized occupation it may hasten the day that those workers will be called expendable.

The tendency is to consider the problem as one that particularly affects the factory production worker, but there are at least as many, if not more, white collar and middle management jobs which are vulnerable to the sweep of cybernation. Many types of inventory control, routine clerical operations and all manner of data processing are grist for the computer mill. With each passing year the computer is involved in decision making situations of greater complexity.

It is most likely that within the productive lifetimes of most adults now of working age there will still be jobs for the well-trained in education, in service industries and in upper echelons of management where one will need to work as hard as ever before. Data to digest, and react to, will pour out in increasing flow. For the ageing workers, the young, the untrained and the members of racial minorities the picture at the moment is far less satisfactory. We are not at all well prepared to know what can be done with the workers from these groups who will eventually be displaced.

The amount of information on the problems of automation, cybernation and unemployment from both government and private sources is immense. Only a sampling will be suggested here. It is a topic which students are ordinarily interested in exploring thoroughly, however, particularly with regard to the possibilities for employment in their own field of interest.

Tape References

San Jose State College Tapes

CAM-3 (Side 2) - "Field Trip to an Automated Bakery"
R. Popkin, trip director

CAM-6 - "Report on Cybernated Companies and Their Experiences With Cybernation"
Ely Brandes, Economist, Stanford Research Institute

CAM-8 (Side 1) - "Cybernation and Industrial Relations"
Dr. George C. Halverson, Chairman,
Dept. of Ind. Relations, San Jose State College

Center for the Study of Democratic Institutions, Santa Barbara, Calif.

CSDI-37 - "Labor Looks at Itself"
Representatives of U.A.W., W.H. Ferry, Paul Jacobs

CSDI-78 - "The Bleak Outlook: Jobs and Machines"
Gerard Piel, Robert Theobald, Ralph Helstein

CSDI-239 - "Technology and the Unions"
Ralph Helstein

Film References

"Automation" (In three parts)
Walter Reuther, Thomas J. Watson, Jr.,
Dr. Gordon Brown, McGraw-Hill

"This is Automation" Produced by General Electric

"A Numerically-Controlled Machine Tool"
Massachusetts Institute of Technology

"The Control Revolution," N.E.T., Indiana University

Articles and Books

Automation - Economic Implications and Impact Upon Collective Bargaining
Int. Brotherhood of Pulp, Sulfite and Paper Mill Workers, 2nd Ed., July, 1964

Buckingham, Walter, Automation, Its Impact on Business and People
Mentor, New York, 1961

Michael, Donald N., "Cybernation and Social Change," Seminar on Manpower Policy and Program, U.S. Dept. of Labor, Nov., 1964

Silberman, Charles, The Myths of Automation, Harper & Row, New York, 1966

Simon, Herbert A., The Shape of Automation, Harper & Row, New York, 1964

Special Issue on Automation, Advanced Management Journal, 29:2, Apr., 1964

III E. BASIC FACTORS #2 - CYBERNATION AND ECONOMICS

It has been noted that nobody can now surely say if cybernation will raise unemployment in this country to critical levels. Some observers have stated that unemployment may reach 25 or even 50% or more of the employable population at the end of the next two or three decades. These predictions are most likely unduly alarmist, but even a constant minimum of 7 or 8% unemployed could produce massive disruptive effects on our society.

There is good reason to think at least that the numbers of people engaged in the producing of goods for consumption will not increase in the same proportion as those working in service capacities, and may very well decline markedly. Even now, an appreciably large group in our society, although technically regarded as fully employed in a productive capacity, are actually supported in part by government subsidies or grants or are producing ordnance for war which does not add fundamentally to the nation's wealth. The jobs of others may be protected by featherbedding practices or Parkinson's Law, and for many a full work-week is now less than 40 hours. There is, then, a strong implication that all of our present work force - even accounting for local worker shortages in certain types of jobs and industries - may not be needed for the production of goods.

If this is so, it follows that there must soon be some imaginative economic planning for the future which considers the possible effects of large-scale unemployment. There are a number of perceptive people in and out of government who are doing just this. Aside from re-education and retraining proposals, in general the plans which have been proposed call for some form of guaranteed minimum income. This is different from the guaranteed annual wage which has been a feature of some union negotiations in that it is presumed that the income will be a right of every citizen whether he works any more or not. Dr. Robert Theobald is a leading proponent of this point of view, and has written widely on the subject. Another scheme put forward by Dr. Milton Friedman is that of the negative income tax plan which would not tax low income families, but would pay them money if their income fell below a certain level. Still a third way of getting at the problem has been described in closely similar approaches sponsored respectively by Mr. Louis Kelso and Dr. Louis Fein. Their plans, in brief, call for purchase of new stock issues by low income families from loans guaranteed by the federal government. Since the machine is the primary producer of wealth, its ownership should be more widely distributed.

All of these plans are provocative and class discussion of their relative merits can provide a stimulating seminar. There is, to be sure, a real danger of treating superficially what are in fact very complex economic problems. We have been fortunate in having both Mr. Kelso and Dr. Fein as discussion leaders for our seminars, and in each case we have had a specialist in economics precede or follow the seminar with a lecture on elements of the economic problems of cybernation. The class is also expected to read a number of specified articles on the subject before the discussion period.

Tape References

CAM-9 - "The Second Income Plan," Mr. Louis Kelso

CSDI-78 - "The Bleak Outlook: Jobs and Machines"
(Also recommended for section on industry and labor)

Film References

Filmstrip - "The Second Income Plan," Institute for the Study of Economic Systems, 260 California St., San Francisco, Calif.

Articles and Books

Fein, Louis, "The P.I. Bill of Rights," Change, CSDI, vol. II, No. 5, 1966

Galbraith, John K., The Affluent Society, Mentor Books, New York, 1962

Kelso, L. and Adler, M., The New Capitalists, Random House, N.Y., 1961

Theobald, R., Free Men and Free Markets, Doubleday, Garden City, N. Y., 1965

Lebergott, Stanley (ed.), Men Without Work, Prentice-Hall, New Jersey, 1964

Page, Edward I. "The Reversed Economic Impact of Automation," Adv. Management Journal, 29:2, April 1964, p. 94

III F. BASIC FACTORS #3 - CONCERNS OF THE SOCIAL SCIENTIST

There is a substantial body of thought in the social sciences which holds that technology acts as the dominant force for inducing change in Western society. This is not to discount other influences such as the growth of population or the adoption of new ideologies, but many of these are also fundamentally rooted in technology. With the coming of cybernation, the social changes brought about by technology appear capable of occurring with devastating rapidity, and the social scientist has been presented with urgent demands to try and recognize the bases of change more quickly than before.

Prior to the last decade or so, the social scientists' methods of studying these and other problems were largely qualitative or semi-quantitative. This was necessarily so. While it has certainly been possible to use quantitative information for the development of simple social theories - (and this has been done, particularly in such studies as economics) - social systems are so diffuse and complicated that it takes enormous amounts of data to attempt to produce any apparent long range, predictable order in them. Now, with the computer available to handle the data, a new type of quantitatively-based scholarship in the social sciences has appeared.

Questions have been raised as to whether this approach to determining underlying social principles is valid in view of the intractability of the data, or merely fashionable. Other observers have pointed out that social systems can be altered by the fact of being studied, and thus in no sense can theories yet be constructed on so firm a foundation as in the physical sciences. To this, the social scientists may sometimes rejoin that there is also a Principle of Uncertainty which has been developed for physical systems. In any event, this kind of research will almost certainly continue and proliferate. With the imaginative use of much larger computers and the application of new mathematical approaches, the information available to social sciences may become more manipulable.

Not all of the uses of the computer in the social sciences have been directed toward ends of disinterested scholarship. Many concerned scholars see signs that the political process itself stands in danger of being subverted by computer techniques. This is merely to say that the computer may make it possible for politically-inspired groups of people, for example, to use polling and voting statistics for more accurate analysis of probable voter preferences and trends than was possible when there was no such rapid method available for handling the information. That the computer has not been used for this purpose any more than it has up to the present time may in part be due to the fact that the traditional politician lays his claim to expertise and position on intuitive and experiential methods. He is apt to consider the computer a threat to his status in the political profession, as the assembly line worker would consider cybernation a threat to his job.

There are also other concerns which have to do with possibilities that pre-election forecasts may affect the outcome of elections for example; or with the possible unscrupulous use of information which has been stockpiled on individual citizens in central data banks. These are potential developments which must bear close watching.

On the other hand, the computer has already become an indispensable tool for government planners and administrators. The keeping of records of transactions between the citizen and various governmental units is producing mountains of paper which are physically impossible to handle by traditional means. The computer coupled with techniques of management science will inevitably be required in such areas as control of traffic, treatment of sewage, prevention of crime, and for general information processing throughout all levels of government.

This whole field is one in which even the professional social scientist would have difficulty keeping track of all the available, current literature. Some useful reference material follows, and more is listed in the primary bibliography.

Film References

"Census '60," Univac Division, Sperry-Rand Corporation

"Input/Output Structure of the American Economy," W.W. Leontief, Scientific American

Articles and Books

Borko, H. (ed), Computer Applications in the Behavioral Sciences, Prentice-Hall, New Jersey, 1962

Bowles, E.A., "Computerized Research in the Humanities: A Survey," American Council of Learned Societies Newsletter, Special Suppl. 345 East 46th St., N.Y., June, 1966

Fite, Harry H., Computer Challenge to Urban Planners and State Administrators, Spartan Books, Washington, D.C., 1965

Holsti, Ole R., "An Adaptation of the 'General Inquirer' for the Systematic Analysis of Political Documents," Behavioral Sci., Sept., 1964, p. 382

Pool, I. de S., Abelson, R.P. and Popkin, S.L., Candidates, Issues and Strategies, M.I.T. Press, 1964

III G. BASIC FACTORS #4 - CYBERNATION AND THE PROFESSIONS

The title of this section is somewhat arbitrary and may be ambiguous as well. The definition of "professional" used here is one which implies a specialized college training as a career prerequisite. Physical scientists and engineers are considered professionals in this sense; and as prime movers in the progress of cybernation they deserve attention. Medicine and law are the other professions which are taken as examples. Social scientists and educators are also, of course, professionals but their relation to cybernation is of such a special nature that in this report they are considered in a section of their own.

The professional groups may be examined from the standpoint of how the conduct of their work is influenced by introduction of systematic techniques utilizing the computer; and then how the profession itself as a type of employment may be affected.

The main target of cybernation is generally conceded to be the repetitive type of industrial job - stultifying and depersonalizing - which lends itself especially well to automatic control. In the professions, the tendency is to regard computer techniques as useful tools for eliminating some routine scientific chores; but also being capable of a kind of partnership in solving complex problems.

As an example of a routine technical job one might consider certain kinds of chemical analysis in an industrial laboratory. The position of industrial chemist has traditionally been held by college-trained people, although on subordinate levels the work may be of a sort that can be done by competent high school graduates. Elementary chemical analysis is generally done by batch processes. By utilizing a systems approach in conjunction with commercially available instruments, a professional chemist can now design highly automated analytical schemes based on a continuous process. Such systems are very much like the programmed control of industrial plants. Chemical analysis may in fact be an integral part of an industrial process as in the computerized handling of spectrographic analyses in steel mill process control. The result is that professional industrial chemists at top levels have work of greater complexity to do in designing analytical systems, while subordinate jobs may be eliminated.

It is important to observe that routine work may sometimes also occur in a highly theoretical context. The determination of the structures of DNA and RNA (long chain molecules carrying programs of instructions that decide the shaping of living organisms) requires most tedious calculations which would be almost out of the question without the computer.

The computer serves the applied and research scientist or engineer well by helping to devise complex experiments in the most efficient manner, controlling routine laboratory work, permitting simulation of expensive or dangerous experiments, reducing large amounts of data to simpler form, and determining optimum design. The imaginative professional in these fields, if he avoids the mistake of measuring everything before deciding what is worth measuring, can only benefit by partnership with the computer. Displacement of careerists by cybernation does not seem likely except in the case of those with professional training who are now doing sub-professional work and do not have the capacity for upgrading.

It appears that the professions of medicine and law will also be markedly affected by the computer, but in a somewhat different way. For one thing, since doctors and lawyers are largely self-employed, the pace of computerization of professional functions will be determined more by the individuals and groups of individuals involved than by employers. For another, although a strong foundation in quantitative science is becoming increasingly more important in medical training, the majority of medical practitioners still rely a great deal on the arts of medicine. Diagnostic programs, although available now in simplified experimental form, will undoubtedly be accepted slowly by the average practicing physician; while automatically controlled devices to extend the surgeon's skill, and computers for statistical research and reduction of data will be more readily adopted. In other words, the computer can be expected to continue to have a more immediate and vital role in medical research conducted in universities and institutes and in the management of hospitals than it will in private practice, although even there information networks will become increasingly important.

In the profession of law, the one obvious area in which computers can be of use is in information retrieval. This can be a difficult programming problem, however, and even more difficult is information analysis. The computer can certainly generate problems for the legal profession having to do with assigning responsibility for computer error, for example, or with the unauthorized use of computerized data; but its employment in a positive sense will come somewhat slower than for the other professions mentioned. Nevertheless there will undoubtedly appear certain intriguing social problems. If there are those who might even consider the possibility of programmed legal decisions - and there are - then it behooves the lawyer to broaden his training to consider the possible implications of the computer.

Students from many fields enroll in Cybernation and Man, and discussions of the future course of their chosen profession along the lines of the foregoing summary have provided interesting class sessions. Some examples of background sources of information for such a discussion follow.

Tape Reference

CAM-5 (Side 1) - "Cybernation in the Professions," R. Parkman

Film References

"CERN 66" - (Theoretical research with the computer), Control Data Corp.

"Computer Sketchpad" - (Partnership in design), M.I.T.

"Managers and Models" - (Computer simulation and design), Univ. of Indiana

Articles and Books

Coons, Steven A., "The Uses of Computers in Technology," Scientific American, Vol, 215, No. 3, Sept., 1966, p. 176

Cooper, Daniel I., "The Automated Laboratory," International Science and Technology, Dec., 1964, p. 20

Davis, John F., "Computers in Medicine," International Science and Technology, Dec., 1960, p. 40

Greenberger, Martin, Computers and the World of the Future, M.I.T. Press, 1964

Masturzo, A., Cybernetic Medicine, Thomas - Springfield, Ill., 1965

Oettinger, Anthony, "The Uses of Computers in Science," Scientific American

Schmidt, Lucien, "Automated Design," International Science and Technology, June, 1966, p. 63

Sterling, T.O. and Pollack, S.L., Computers and the Life Sciences, Columbia University Press, 1966

III H. BASIC FACTORS #5 - THE COMPUTER AND THE MIND: ARTIFICIAL INTELLIGENCE

From the time he first began to write down his tales, man has shown a fear of the results of his own creative ingenuity. The stories of Icarus, who flew too near the sun on the wings his father had made; the Golem, of Jewish folklore; and the Sorcerer's Apprentice of Goethe are all examples of that concern. In the 19th Century this kind of story was an obvious reaction to the excesses of the First Industrial Revolution and the machines that fueled it. In Samuel Butler's Erewhon, one of the characters says grimly, " . . . The present machines are to the future as the early Saurians to man; what I fear is the extraordinary rapidity with which they are becoming something very different to what they are at present. . . . Is it not plain that the machines are gaining ground on us when we reflect on the increasing number of those who are bound down to them as slaves, and of those who devote their whole souls to the advancement of the mechanical kingdom?" Mary Shelley's Frankenstein has come to epitomize for us tales of this genre, although Frankenstein's monster was actually a creature of flesh and blood.

There are many recent examples of novels, short stories, T.V. plays, etc., in which the machine that masters its creator resembles some kind of computer.

It is evident that many people are becoming increasingly uneasy about machine processes which to them are bearing a closer and closer resemblance to human thought. In a class containing students from many disciplines, the question, "Will the mind of man always prevail over the machine?" becomes a provocative one for study and discussion.

"Artificial intelligence" is an active field of scholarship in philosophy and in the sciences. The problem of whether or not machines can "think" or "learn" inevitably revolves around an acceptable definition of those words, and of a further stimulating question, "Are living organisms fundamentally the same as machines?"

If we conceive of a machine as a system for performing some function, we can begin to make sense of the problem. A. M. Turing, a British mathematician, devised a logic machine which, in principle, can accomplish any task that any other machine can. It was a concept at once powerful yet simple. Directing it to the possibility of a machine's imitating man, he thought up a game which consists of questions asked by an interrogator of a man and a woman together in another room. The object of the game is to determine by written answers which respondent is the man. The woman is permitted, as a rule of the game, to assist the interrogator, and she can write "I am the woman," but the man who is not bound to truth, and whose role is to try to cause misidentification can do the same. Now if the programmed machine takes over the part of the man, the underlying question would be to determine whether the interrogator could correctly distinguish between the two respondents more often in the second instance than in the first. This is the question that Turing used to replace the original one, "Can machines think?" This brief example cannot begin to give the sublety of Turing's notion, but it is possible to show in an extended class discussion that the game can be structured to rule out as irrelevancies, questions regarding the slower computing speed of the human, or greater charm of the woman.

"Can a machine learn?" Again we must look to our definitions. In his book, God and Golem, Inc., Norbert Wiener defined a learning machine as " . . . an organized system which can transform a certain incoming message into an outgoing message, according to some principle of transformation. If the transformation has a criterion of merit of performance, and the performance improves, then the machine has learned." Dr. Arthur Samuels, while at I.B.M. Corp., developed a computer checker player which can play a respectable game against a competent opponent. His kind of programming is discussed in the article, "System Analysis and Programming" by C. Strachey in the September, 1966 issue of Scientific American, and it is a useful exercise for students to examine it. It is possible in the design of such a machine to combine certain criteria of good play in order to give a figure of merit for each succeeding move. If the machine selects the next move each time according to the largest figure of merit, the game is rigidified, but it is also possible for the machine to keep a record of past plays, and then at the end of each game determine new figures of merit. One can now say that the machine is transforming itself on the basis of experience, and may even demonstrate subsequently some aspects of the playing habits of its human opponent. According to the above definition, this is learning.

A strongly negative response to this kind of question, and especially to some of the general cybernetic assumptions, has been made by many philosophers, engineers and scientists who point out that the computer must always be programmed initially by a human. Mario Bunge, formerly Professor of Philosophy of Science and Theoretical Physics at Buenos Aires University has written in his book Metascientific Inquiries, " . . . Strictly speaking, computers do not compute, machines do not think, but they perform certain physical operations that we coordinate with certain mental processes. . . . Without the interaction of man's abstract and purposive activity, which has no counterpart in machines, the most expensive digital computer is mere scrap iron."

It is indeed true, that in spite of many advances in studies in this area, the human brain has steadfastly resisted having its action described in completely mechanistic terms. Biological investigations have shown that the brain does not, for instance, react to point-by-point visual stimuli; but asks for information about areas and objects and their relation to what surrounds them. The process of discrimination is immediate. Furthermore, the manner in which the brain integrates knowledge before storing it; or the way that knowledge is stored and then retrieved is not understood.

Whether answers to the questions about artificial intelligence will be found in new theories and designs of machines or in attempts to describe the human nervous system in physical terms cannot now be said; but one can hardly doubt that there are revolutions yet to come in such fields as neurophysiology and solid state physics. Machines of the future may very well be of such complexity that completely new phenomena will emerge.

Tape References

CSDI - 105, "The Quantitative Society"

Film References

"Computer and the Mind of Man," Indiana University

"Computers and Human Behavior," " "

"Engine at the Door," " "

"The Living Machine" (2 parts), National Film Board of Canada

Articles and Books

Arbib, Michael A., Brains, Machines and Mathematics, McGraw-Hill, N. Y., 1965

Bronowski, J., The Identity of Man, Doubleday & Co., Garden City, 1965

Crosson, F. and Sayre, K.M. (eds.), The Modeling of Mind: Computers and Intelligence, University of Notre Dame Press

Culbertson, James T., The Minds of Robots, Univ. of Illinois Press, 1963

Feigenbaum, E.A. and Feldman, J. (eds.), Computers and Thought McGraw-Hill Book Co., New York, 1963

Fink, Donald G., Computers and the Human Mind, Doubleday & Co., Garden City, 1966

George, Frank, The Brain as a Computer, Pergamon Press, 1961

Hook, Sydney (ed.), Dimensions of Mind, Collier Books, N.Y., 1961

Minsky, Marvin L., "Artificial Intelligence," Scientific American, Vol. 215, No. 3, Sept., 1966, p. 246

Rosenblith, Walter A., "Computers and Brains," Applications of Digital Computers, Freiberger, W.E., and Praeger, W. (eds.), Ginn & Co., Boston '63

Turing, A.M., "Can A Machine Think?" The World of Mathematics, Vol. 3, Simon and Schuster, N.Y., p. 2099

Walter, W. Grey, The Living Brain, Penguin, 1961

Wiener, N., God and Golem, Inc., M.I.T. Press, 1964

III I. BASIC FACTORS #6 - CYBERNATION AND THE UNDERDEVELOPED AREAS

No world problem has more potential for catastrophe than the rapidly growing gap between the poor nations and the affluent ones. Industrialization has opened this gap, and cybernation will increase it to a critical degree.

It has been substantially accepted in the governing councils of the most affluent nation of all - our own - that we ought to do what we can to help raise the standard of living in the poor nations of the world to at least above the starvation level. As soon as ways are sought, however, the staggering complexity of the situation becomes apparent.

The population "explosion" is one of the basic causes of the problem. This startling growth is itself partially a consequence of advances in technology and science; but, at the same time, future population control and the feeding of the hungry millions already on the earth cannot be accomplished without using the principles and devices of applied science. It goes almost without saying that agricultural methods need to be updated. However, some of the backward countries have chosen to apply a large proportion of the limited financial resources available to them, towards developing a potential for heavy industry. What should their course, and ours, be?

In the limited course time available to explore the problem of cybernation and the underdeveloped areas we have chosen to focus on the following questions. "Would it be possible or desirable, given a nucleus of scientifically and technically trained people and reasonable financial help for a specified underdeveloped area to proceed directly from an immature economy to one relying heavily on cybernated industrial techniques and scientific systems management? Could this be done without going through an intermediate stage depending heavily on the utilizing of manual skilled and unskilled labor and techniques typical of the First Industrial Revolution? What conditions would have to be postulated to make a discussion of this kind meaningful?"

The first question is directly related to a number of the other topics of inquiry in the course. It implies as yet unproven the assumption that the most pressing need in the underdeveloped countries is for factory jobs for the millions to allow them to pay for the necessities of life. It asks if there is a way that these countries may survive, while avoiding the degradation of the physical environment which has resulted in Western nations from heavy industrial concentrations. It wonders whether the way of life in some of these underdeveloped countries may not already have in it important elements which could be destroyed by indiscriminate industrialization. In the first two semesters of the course we chose as our model, for a case study project, an impoverished province in Northeast Brazil. This area was selected primarily because one of our engineering staff members had worked there with a team sponsored by the Agency for International Development; and was able to offer a rich background to the study. It became apparent that for the study to be useful it was necessary to go in some detail into theories of the processes of cultural change, the economics of the region and the country, and to learn much more about the indigenous culture than there was actually time for. In subsequent semesters, therefore, we have selected as a model for our study the region of Appalachia in the United States. Here there are all the elements of an economically and culturally "backward" region, but we can more readily comprehend the cultural differences. The interaction between this and contiguous regions in the process of cybernated industrialization have a recognizable relation to other topics in the course.

This assignment is described in the Appendix along with an example of a student paper discussing the problem.

Tape Reference

"The Rich Get Rich and the Poor Get Poorer," Vera Micheles Dean
Canadian Broadcasting Corporation (Released by Robert Theobald)

Film References

"Area of Action" (Electronic data processing in the Pacific nations)
I.B.M. Corp.

"Can the Earth Provide?" (Will Science be able to feed mankind),
McGraw-Hill

"Tomorrow . . . Today" (Electronic data processing in Latin America)
I.B.M. Corp.

Articles and Books

Agarwala, A.N. and Singh, S.P., The Economics of Underdevelopment,
Galaxy, New York, 1963

Bowman, Mary and Haynes, W., Resources and People in Eastern
Kentucky, Johns Hopkins University Press, 1963

Caudill, Harry M., *Night Comes to the Cumberland,* Atlantic, Little, Brown, Boston, 1962

Foster, George M., *Traditional Cultures and the Impact of Technological Change,* Harper and Bros., New York, 1962

Kelso, Louis and Hetter, Patricia, "Uprooting World Poverty, A Job For Business," *Business Horizons*, Fall, 1964, p. 37

Meier, Richard L., *Science and Economic Development*, M.I.T. Press, 1966

III J. BASIC FACTORS #7 - CYBERNATION AND THE PROBLEM OF LEISURE

As stated in an earlier section, the wide-ranging discussions which take place in Cybernation and Man are directed more towards raising questions in the minds of students (and faculty) than towards attempting to provide oracular answers. Hopefully, light will be shed on some very complex matters and guide-posts staked for further exploration.

The effect of cybernation on employment is not easy to assess, but it seems reasonable to assume that in the future more people in western nations will have more time to spend apart from gainful employment than they have had since the beginnings of the industrial system.

Certainly the average length of the official working week for production workers has dropped markedly in the past 100 years and a decrease is continuing in many kinds of jobs. In addition there is a verifiable trend towards later entry into the labor market and earlier retirement. Perhaps, too, life expectancies will continue to increase.

There are, it is true, countervailing tendencies. Many workers will take second jobs if their ends cannot be met by pay from the first. Executives often work 60 or more hours a week and never have a mind to retire. It surprises some to hear that there are even a few teachers who put in these kinds of hours. However, if technology and the computer should, in the future, be used to their full potential by the overworked administrator or any others who are now swamped by detail, this picture might also change.

Let it be put, then, that there is going to be much of the world's work for the well-trained to do in the next few decades, but the numbers of people in Western societies who cannot or do not need or wish to find work for wages will probably increase. What then will this latter group do?

To look into the question one must grapple with the problem of leisure in a cybernated world, and leisure is a seriously misunderstood word. One writer who has examined the meanings of leisure very successfully is Sebastian de Grazia in his book, Of Time, Work and Leisure. This is one of the recommended texts for students to read in Cybernation and Man.

It is essential that a distinction be made between leisure and free time. We in America are accustomed to speak of leisure time when we mean free time, or time away from the job. Our activities in this free time may be anything but leisurely. If a man leaves home on the freeway at 7 A.M. and returns at 6 P.M. from an 8-hour job, are the extra three hours a part of his leisure time? One suspects that the two hours commuting will not be. The categorizing of the remaining hour may depend upon whether the luncheon was convivial or businesslike, but even if convivial the clock would probably have to be considered. Is wandering up and down the aisles of a supermarket selecting the week's supplies a leisurely activity for the housewife, or did the older system of having the groceries sent out to the house serve her leisure better?

There is some evidence that many of the efficiencies of industrialized society, while satisfying the system very well, may sooner or later add to the trappings complicating the life of an individual. If a mature teacher should ask a class of students whether they have ever sat on a porch swing watching the world, or a small part of the world, go by, he is likely to get a variety of answers beginning with "What is a porch?" or perhaps "What is a porch swing?" If they were raised in an older part of town, and their grandparents still live there, perhaps they know that experience: but it is unlikely that their children will, or would want to for that matter.

And what about freedom of choice? Has technology, and the affluence it breeds, expanded the freedom to choose what one's activities will be? Yes, it has. Observe the increasing numbers of people each year who can travel abroad and do new things their parents could only have dreamed about. Still, as the world gets smaller it loses some of its variety. If the only accommodation left in Paris is the Hilton, and it takes 12 hours to drive 150 miles in England during August Bank Holiday, then what price freedom of choice? What price freedom of choice too for those who are not working because with their kind of training there is no work to be had?

The channels for using free time may be narrowing. The public and private means of transportation are slowly being choked, parks are overflowing many times of the year, and the act of finding recreation may get so encumbered that the feeling of pressure and conpulsion is inescapable. Whatever this is, it is not leisure. In fact play is not true leisure either if it serves only as a relief from tensions of work. This is not to say that such play is not desirable or necessary.

Not everyone may agree that it is becoming difficult to derive pure enjoyment from the more common uses of free time, but those who do may be forced to a re-examination of the meaning and virtue of leisure. Leisure has in it no trace of compulsion to do. It is not freedom from work - indeed it should have no converse relation to work at all. Neither is it abundance or slothfulness, because it may mean active engagement, but only in something desirable for its own sake. It may consist of very small joys, but they will be spontaneous. Above all, and this touches the heart of the large problem, an enjoyment of leisure is greatly stimulated by the foundation of a broad, thorough education, and a culture not too heavily freighted with the Puritan ethic of hard work. Paradoxically, as we have stated, the well-educated will not lack for work to do, and so it appears that those who will have the most free time may be the least prepared to take time for leisure.

There have been a number of questions raised under this heading of the kind that have been shown in the Cybernation and Man seminar sessions to motivate spirited discussion, and a desire on the part of some students to look into the subject at greater length. A useful group of references for this purpose follows.

Tape References

"Education for Freedom," Frank Tannenbaum, Canadian Broadcasting Corporation (Released by Robert Theobald)

CSDI - 315 - "The City of the Sun"

Film Reference

"Of Time, Work and Leisure," de Grazia, N.E.T., Washington State Univ.

Books and Articles

De Grazia, Sebastion, Of Time, Work and Leisure, Doubleday, Garden City, 1964

Fabun, D. (ed.) The Theory of the Leisure Masses, Kaiser Aluminum News #5, Kaiser Corporation, Oakland, Calif., 1966

Kaplan, Max, Leisure in America, J. Wiley & Sons, New York, 1960

Larrabee, Erick and Meyersohn, R. (eds.) Mass Leisure, The Free Press of Glencoe, New York, 1958

Lee, Robert, Religion and Leisure in America, Abingdon Press, N. Y., 1964

III K. BASIC FACTORS #8 - CYBERNATION AND EDUCATION

One theme which keeps recurring in the discussions of many of the topics previously cited is the challenge which technological development poses for the whole educational system. This is a many-faceted challenge, but essentially its thrust is in two major directions. The first is a demand for education to rethink its mission in the light of changes which cybernation can produce in our way of living. The second is, or will be, a nearly inevitable requirement that education reshape its methods, to take care of all of the students who will be entering the schools.

To the first demand, educators are justified in pointing out that there are very few professions which are more inclined to self-evaluation than education. A teacher sometimes feels a large part of his time is spent on curriculum restudies. Not always, however, do such studies reflect an understanding of the magnitude or rate of current technological development; or sometimes, as in the immediate post-Sputnik period, there is an over-reaction for reasons that have not been completely thought through.

If it is true that many sub-professional jobs related to the production of hard goods and processing of information will be eliminated by the computer, should this be considered in the shaping of pre-college curricula? Are there now students learning typing and shorthand, lathe operation, bookkeeping or drafting with a view towards gaining employment in these fields in ignorance of their eventual vulnerability to cybernation? If not, must the schools then provide, for students who do not intend to go to college, some kind of preparation for work in, say, the fields of recreation or social service; or should they try to emphasize self-development in the arts of living? And if the latter, what kind of success can be expected with children from home environments where books have no place?

Not the least obstacle to re-evaluation of the mission of the public schools is the fact that many teachers, and in particular their administrators, were brought up prior to 1945, when the new age may be considered to have begun. To communicate successfully with their students in an age of cybernation, the teachers, too, must be aware of the changes taking place; and this would seem to require an extensive re-education about the facts of technology. In whatever way it may be accomplished - whether through summer schools, or institutes, or internships sponsored by enlightened industries, the need for this kind of program is there.

It is not a wonder if the conscientious classroom teacher should begin to despair at the size of the job he is asked to perform. Some now see, however, a possible way to help him with his burden. Their approach relates to the second challenge to the educational system mentioned earlier, and would employ a wide array of devices and methods ranging from some of the more familiar audio-visual aids in their latest manifestations to computerized teaching systems.

Audio-visual aids have been a part of the educational structure for many years, generally in the form of radio, films or classroom models. Used imaginatively, they can provide additional stimulation to students, but where audio-visual departments are inadequately financed or staffed the burden for scheduling and presenting the program falls on the teacher. A most time-consuming task of the conscientious teacher is the programming of events requiring extra-classroom aids to fit smoothly into the context of the current work unit. Certainly one of the uses of the computer may fall in the area of controlling logistics of school and classroom management.

Instructional television has been used in the schools for more than 10 years, and the results still appear to be spotty. Available studies show that ITV is used to a much greater extent in the primary schools than in the secondary schools or colleges. Even where it has found appreciable employment, it has largely been as a supplement (often optional) to the traditional instruction. Instructional television is an expensive medium and truly innovative programs require a combination of creative talents which are not often available to any but the most well-endowed or resourceful projects. It may be that ITV will only receive optimum use in the classroom in eventual combination with other new products of technology and science such as computerized instructional systems.

The early teaching machines which merely permitted the display of a "correct" answer, and which then moved on to another frame, have been superseded by much more complicated instructional programs by means of which a student can learn a body of material at his own speed. Even the newer programs are restricted teaching devices. Quite apart from the fact that they are almost prohibitively costly, it appears at this time that the concept is most successful with job or skill-oriented instructional material which is easily defined, but it is of far less utility with more subjective studies. However, the flexibility of the computer in modifying its own performance opens up, when applied to programmed instruction, theoretical possibilities for eventually accounting for individual differences in the way students learn. This must be the most important goal of work now being done at such universities as Harvard, Stanford and Pittsburgh - that is, the creation of a clearer understanding of the whole process of teaching and learning.

The invasion of the classroom by technology has begun and it is bound to continue. There is no current prospect that there will be enough good teachers to do the job of educating the young. What good teachers there are will be overwhelmed by the magnitude of their task without the aid of every suitable device of technology that can be put at their disposal. Perhaps the present structure of the schools will become unrecognizable in the lifetimes of those who are now students. Education is considered a promising field of venture capital for industry, and some industrial spokesmen demonstrate an impatience with what they consider archaic methods of teaching. Industries are now bidding for contracts on teaching projects and designing new educational systems. Educational research is receiving support that it has not had before.

That these developments can be potentially threatening to the educational process is a possibility not ignored by thoughtful observers. There will be strong pressures from some businesses, and from tax-conscious politicians to speed up the technologizing of the schools if there are indications that apparent monetary savings can thereby be accomplished. It will be easy to become hardware-happy, but, by whatever means, the sensitive relation between teacher and pupil at its best must be preserved. Constant vigilance will be required to see that the machine does not intervene.

Film References

"Child of the Future," (Technology in the Classroom) National Film Board of Canada

"SDC's Automated Teaching Project," System Development Corp.

"The School Information Center," (Data processing equipment in a secondary school system) I.B.M. Corp.

"The Teaching Machine - A Psychological Experiment" - (Drs. Skinner & Herrenstein - Harvard Psychology Labs.)

Articles and Books

Brickman, W.W. and Lehrer, S. (eds.), Automation, Education and Human Values, School and Society Books, New York, 1966

Lumsdaine, Arthur and Glazer, R. (eds.), Teaching Machines and Programmed Learning, NEA, 1960

Murphy, Judith and Gross, Ronald, "The Unfulfilled Promise of ITV," Saturday Review, No. 19, 1966, p. 88

Nilsson, Nils J., Learning Machines, McGraw-Hill Book Co., New York, 1965

Oettinger, Anthony G., "A Vision of Technology and Education," Communications of the Association for Computing Machinery, July, 1966 - Reprinted by Harvard University, Program on Technology and Society

Silberman, Charles E., "Technology is Knocking at the Schoolhouse Door," Fortune LXXIV, No. 3, Aug., 1966, p.120

Suppes, P., "Plug-In Instruction," Saturday Review, July 23, 1966, p.28

III L. BASIC FACTORS #9 - CYBERNATION AND HUMAN VALUES

The interrelationships among the several topics which have been briefly summarized here will not escape the attention of the thoughtful student for long. He will observe too - in fact the point will have entered into some of the discussions - that there are fundamental moral questions underlying nearly every aspect of the man-machine symbiosis.

There has been a noticeable tendency among some students with academic backgrounds in the fine arts and humanities to bring with them the notion that technology is almost pure threat - that its ultimate thrust is toward the diminishing (if not the extinguishing) of the individual. This point of view is clearly part of a humanistic tradition which, contemplating the effects of technology, rejects the idea that there is inherent good in mechanized efficiency. It is the nature of man to be imperfect, so man seeks perfection in the machine. But achieving progress by way of this perfection, he must pay for it, at the least by accepting a measure of uniformity, and at worst by relinquishing control of the life-enhancing processes.

There is a pivotal question asked by the humanist, "How high a price are men willing to pay for material progress?" He is concerned that too few in the technological hierarchy seem to be asking this question themselves.

Many engineers and technologists are, in fact, unimpressed by these concerns. They have a pragmatic faith in the demonstrated effectiveness of their own methods and devices; and are impatient with what they consider unrealistic carping from a basis of technical ignorance. For them, the question, "What is a machine for?" has an obvious answer. They see no virtue in nostalgia.

Others find these questions worth reflecting on. While aware that the eventual results of development of highly "intelligent" machines could conceivably lead to a frightening de-humanization of man; they also feel, optimistically, that the methods of technology, by eliminating brutal animal toil, *can* offer him a chance to make the most of himself. Technology and science help to reduce ignorance but this process, unlike the spawning of material goods, is a slow one. What we like to think of as the "knowledge explosion" is largely a massive compiling of facts. It appears time, now, to synthesize these facts into a unified system for the good of man, and we surely want to use the most effective method to do so. Such a synthesis calls for the efforts of humanist, scientist, and technologist. Neither should they shrink from trying to find an answer to the question, "What is the 'good of man'?" Considerations of ethics and morality will not be solved by mathematics, but they are a legitimate concern of a college class dealing with cybernation.

Among the resource materials which students will find helpful for class discussions on these questions are the following.

Tape References

CAM-1 (Side 1) - *Cybernation: A Blessing or a Curse?*, S.P.R. Charter
(Side 2) - *The Creative Process in a Man-Machine World,*
S.P.R. Charter

CAM-7 (Side 1) - Human Purpose in a Man-Machine World, Alice Mary Hilton, S.P.R. Charter
(Side 2) - Thoughts on the Triple Revolution, W.H. Ferry

CAM-8 (Side 2) - Problems of a Changing World and the Social Context, H. Hodges

CAM-10 - Class Discussion - Cybernation and Man, S.P.R. Charter

Film Reference

Tomorrow, (Automation and Society), United Church of Christ

Articles and Books

Bloy, Myron B., Jr., "Technological Culture, the University, and the Function of Religious Faith: in Automation, Education and Human Values, School and Society, New York, 1966

Charter, S.P.R., Man on Earth, Contact Editions, Applegate Books, Box 22124, San Francisco, 1962

Goldberg, Maxwell H., "The Impact of Technological Change on the Humanities" Educational Record, Fall, 1965, p. 388

Kranzberg, Melvin, "Technology and Human Values," Virginia Quarterly Review, Vol. 40, No. 4, Autumn, 1964, p. 578

Mangum, Garth L. "Automation, Employment and Human Values," The Educational Record, Spring, 1964, p. 122

Wilkinson, John et al, Technology and Human Values, Center for the Study of Democratic Institutions, Santa Barbara, 1966

III M. ADDITIONAL DISCUSSION TOPICS

Basic factors for class study and discussion have been summarized briefly in the preceding sections IIIA through III L. It will be recognized that there are many aspects of the given subjects which were not pointed up in the summaries, but which could become a part of any thorough treatment of the material.

Nor are there represented in these summaries all topics of importance to the man-machine relation. Others, which have been discussed in the Fall, 1966 semester or are contemplated for the future include:

Cybernation and Urban Development
Cybernation and Agriculture
Cybernation and Civil Rights
The Concern of the Artist in an Age of Technology
Cybernation and Transportation

The instructor who may have an interest in pursuing these subjects will be able to find relevant references in the primary bibliography.

IV. CYBERNATION AND MAN FIELD TRIPS

Each semester there are two or three organized field trips which the students are required to take during the regularly scheduled activity periods. There are many different kinds of facilities in the San Francisco Bay Area whose operations relate well to the main interests of the course. Preferably, the trips will include an activity which is largely automated but which may not have computerized control systems; and one which relies heavily on the computer.

Before each trip the student is briefed about the nature of the facility he will visit, by means of a short class discussion and a written commentary which he is asked to study carefully. An important part of the trip itself is the discussion session with the tour guide who will have been thoroughly informed in advance, through personal interview, of the nature of the course and its objectives. Mr. Ralph Popkin of the staff of the School of Engineering, has acted as coordinator of the field trips, and has prepared the trip commentaries, examples of which follow.

FIELD TRIP NO. 1

The first field trip will be to a bread baker. The one we will visit is admirably well suited to our study of an automated activity. This particular bakery is presently the most modern in this area, yet it is scheduled for early remodeling in order to further automate the activity. The plan has a "batch" process production line and a "continuous" process production line. These lines have many of the mechanical and electrical devices which constitute the unique "hardware" of automation.

Of equal importance with the observation of the machines and the techniques of automation is the observation of the role of the people involved in the activity. We will observe both men and machines for a brief period of time. What we will see, however, is a transitory condition, a stage of technological development. Consequently, we shall try to broaden the view of the plant by discussion with our guides. We will be able to learn of the technology of the manufacturing process and the roles of the bakers as they were, and we will be able to discuss what future developments are planned in terms of machines and men. You are urged, therefore, to observe carefully the characteristics of the production line, the automation hardware, and the jobs that the men are doing. Think, if you will, about why they are needed at all! Think, also, about what economic pressures determine their displacement by machines. Observe the mechanisms by which they are displaced. Reflect on the nature of the work of the remaining positions, and finally, decide if you can, whether every activity, including management as it presently functions, can be displaced by machines. The problems of displacement of human beings by machines is dramatically illustrated in the history of this plant. The concomitant question of "What will these people do?" is immediately raised as a consequence to the observation of their displacement.

This bakery is representative of every productive unit. What you see in this bakery is common to all automated activities and is simply a lower stage of technological development than the cybernated activity which we will visit on our next trip. The elements of the productive process are essentially identical. The hardware is a little less sophisticated in the bakery and the information storage and decision making is simpler. In the case of information storage, the bits are kept in written, visual form and in the minds off the managers. Decision making resides in management, men who have access to the information stored in the company books and in their minds. In the case of the cybernated plant, machines will store huge amounts of information and make information available to management so effectively that, in actuality, the machines may be said to be able to make decisions.

In the bakery you will see how a single man with a machine in this case, and a fork lift truck, handles every raw material entering the plant. However, he and his truck will soon be displaced. The activities in which skill and judgment are required still exist. Try to find them.

Observe the mechanisms that determine automatic operation. The endless belt, the temperature controller, level controllers, variable speed drives, and electric "eyes." As an engineer, you would be concerned with the design of combinations of these elements. As a manager of a plant, you would be concerned with the reliability and capability of these devices. As a teacher, you would be concerned with transferring to the young the meaning of these devices as technique and as elements providing release from animal toil. As a citizen, you may be concerned with the inexorable consequences of the combinations of these elements upon the social, political, economic, and personal aspects of society and upon yourself as a member of society. What you see in this bakery are the machines that were, that are, and what may be; you may also see what the effects of the machines which were there before had on the lives of the men there and their society, what effects the present machines have on the men there and on our society, and what the future machines will do for men and for you, and finally, what relationship will you bear to machines with which you will be involved, whether it will be a computer, a television assembly plant, a classroom teaching machine, or a bread baking line.

FIELD TRIP #2

The second scheduled field trip will be to a data processing facility. This particular facility is a plant that processes data delivered to it from a number of bank branches.

You will see the form in which the data is delivered and its handling until it is stored. You will discuss with our guide the nature of the data, the volume, and the uses of the data.

This processing plant is analogous to the bakery in many respects. The raw material is different, the bakery used flour and chemicals. This data processing plant uses paper as raw material. The bakery uses a chemical process to effect the desired transformation of the raw material. The data processing plant uses physical and electronic processes to transform the raw material. The end product of the bakery is wrapped bread ready for the consumer. What is the end product of this plant?

As in the bakery you will see people doing certain things. What they are doing determines why they are there. As in the bakery, they are there simply because the devices are not yet installed which will displace most of them. In the case of this particular plant, it is interesting to note that there are several like it in California. All but two will be shut down and all the work done at the remaining two plants. The two plants may become one and it is certainly possible that this plant may service other businesses in this state and in other states in this region. What you are seeing, therefore, at this plant is a stage in a rapidly changing development.

This plant is, you will remember, a computerized plant. As we contemplate the field trip before we go and as we go through the plant and discuss its operation, it would be important to redefine in our minds the various levels of technology as reflected in modes of production of goods and services and the roles of various people involved. What are unique elements in this particular environment? What functions of the plant are cybernated, which functions are automated? What relationship does this plant have to the banking system of which it is a part in terms of providing a service of processing data, storing information, information access, information concerning the branches serviced, controls over the operations of the branches, direction of the entire bank system?

What additional operations can this type of service be expanded and programmed to perform? In a very short time, each of us can find a number of service functions that can be added to this kind of activity and we may be sure that in time, these services will be added. What changes in the lives of all of us will materialize as the result of the application of technology to the banking operation? What other activities, not yet cybernated, will be susceptible to this kind of change within the activity and in turn affect all our lives?

One more aspect to consider is that every productive organization in our society is undergoing the changes that we have seen in the bakery and in the data processing plant, and there is no exception. The application of automation and cybernation appears to be inexorable. How will each of us be changed by these developments and, in turn, how will each of us contribute to the changing technology? In short, how will our lives be changed and simultaneously, how will changes in our lives affect the kinds and rates of technological change?

FIELD TRIP #3

This field trip is to the computerized Traffic Control Center of San Jose. This is a working experimental system of traffic control, the first one of its kind in the United States. It is presently a tool for studying and controlling traffic and it is helping to gain insights and experience in traffic control. The purposes of the system, which are presently definable, will be discussed as will the hardware, the modes of control and strategy.

Several questions come to mind in observing the system in operation. You are encouraged and will be given opportunity to ask questions of your guide, Mr. Mahoney.

In considering this control system, our group is concerned, of course, with the nature of the system, the purposes of control, the effect of control on the individuals and on society, and finally, the effect upon the goals and values of the individual and society. We are concerned equally with the hardware and techniques of control and finally with the capability of the computer to assume complete control, or whatever level of control it is capable of or is considered desirable by whomever directs the computer.

V. COMPUTER ACTIVITY PERIOD

Many of the students who have elected to take Cybernation and Man have come from departments outside of Engineering and Science and have had no previous experience with the computer. For them, a program has been set up in 4 or 5 activity periods to provide some feeling for its strengths and limitations.

Professor Edward A. Dionne, who is in charge of the computer instructional courses in the School of Engineering, has arranged a series of special lectures in computer technology which briefly describe its functional units and physical operation, and which lead up to the writing of a simple program. These exercises together with pertinent films and observation of an industrial data processing system seem to afford a meaningful instructional experience.

The engineering students are asked to act as teaching assistants to those who are just learning, because of a shortage of available teaching time and facilities. It is hoped in time that we will be able to have them work on special problems related to the particular objectives of the course, but this has not yet been worked out in detail.

VI. AUDIOTAPE REFERENCES

There have been a number of audiotapes made during class meetings of *Cybernation and Man*, some of which have been referred to under the summaries of the discussion topics. These have been reproduced in sets of ten tapes, each of which is described in Section A below. Copies of these tapes (in complete sets only) may be obtained for $46.50 by writing to Dr. Ralph Parkman, Department of Material Science, San Jose State College 95114. (Please send checks only, made out to Dr. Ralph Parkman, Cybernation and Man Account.)

Other organizations have also produced tapes about cybernation and closely related topics, and these are described in Sections B and C. Information about purchasing these may be obtained from the organization concerned.

A. Tapes Produced at San Jose State College

1. CAM-1
Side No. 1 - Title: "Cybernation: A Blessing or a Curse?"
Lecturer: S.P.R. Charter, Editor-Publisher, Author of *Man on Earth*
Speed: 7.5. Time: 45 min.
An introduction to some of the basic problems of the new technological revolution. If peace is achieved in 25 years, how will man be employed and how will he occupy his time? Meaninglessness of concepts of capitalism and communism in a cybernated world.

   Side No. 2 - Title: "The Creative Process in a Man-Machine World"
(The 2nd Aldous Huxley Memorial Lecture)
Lecturer: S.P.R. Charter. Speed: 7.5. Time: 50 min.
Provides a definition of creativity. Can the creative process survive in a man-machine world where the perfection of the machine demands a uniform response?

2. CAM-2
Side No. 1 - Title: "History of Man-Machine Systems" - Part 1
Lecturer: Ralph Parkman, Professor of Materials Science, San Jose State College. Speed: 7.5. Time: 45 min.
The distinction between labor and work. Technology and labor in the ancient world. The alleviation of physical labor by the machine and its social consequences at the time of the first Industrial Revolution.

Side No. 2 - Title: "History of Man-Machine Systems" - Part 2
Lecturer: R. Parkman. Speed: 7.5. Time: 40 min.
The beginnings of mass production. Chronology of the "thinking machines," Charles Babbage. The development of modern computers.

3. CAM-3
Side No. 1 - Title: "Field Trip to an Automated Bakery"
Discussants: Ralph Popkin, Field Trip Director, students and plant engineer. Speed: 7.5. Time: 30 min.
A Cybernation and Man class takes a trip through a local, partially automated bakery. Discussion with plant engineer of details of progress, how it is being changed by technology and possible consequences for the worker, the management and the consumer.

Side No. 2 - Title: "Cybernetics - Control and Communication" - Part 1
Lecturer: R. Parkman. Speed: 7.5. Time: 30 min.
The first of a three-part lecture on control and communication. Discusses the need for control in systems, and the requisite conditions for feedback control. Considers mechanical and industrial systems in varying degrees of automaticity.

4. CAM-4
Side No. 1 - Title: "Cybernetics - Control and Communication" - Part 2
Lecturer: R. Parkman. Speed: 7.5. Time: 45 min.
Defines technical communication and gives basic elements of communications systems. Historical basis for codes and beginnings of information theory.

Side No. 2 - Title: "Cybernetics - Control and Communication" - Part 3
Time: 25 min. Information theory for probabilistic systems. Uncertainty and entropy. Social significance of these concepts.

5. CAM-5

Side No. 1 - Title: "Cybernation in the Scientific, Medical and Legal Professions." Lecturer: R. Parkman. Speed: 7.5. Time: 30 min. Present uses and potential consequences of using the computer in industrial and theoretical science and in medicine and the law.

Side No. 2 - Title: "Asexuality in the Man-Machine World" Lecturer: S.P.R. Charter. Speed: 7.5. Time: 45 min. Discusses need for new concepts of individual morality to withstand the threats of the cybernated age.

6. CAM-6

Side No. 1 - Title: "Report on Cybernated Companies and Their Experiences With Cybernation." Lecturer: Ely Brandes, Economist, Stanford Research Institute. Speed: 7.5. Time: 50 min. Case studies of ten companies which introduced some degree of computerized control in their operations. Generalizations growing out of these studies.

Side No. 2 - Continuation of Side No. 1. Time: 40 min.

7. CAM-7

Side No. 1 - Title: "Human Purpose in a Man-Machine World" Lecturers: S.P.R. Charter; Alice Mary Hilton, President, Institute for Cybercultural Research. Speed: 7.5. Time: 50 min. Procrastination and Prognostication in the man-machine age. Can the past have viability in the present age, when machine controls machine? The need for establishment of human purpose.

Side No. 2 - Title: "Thoughts on the Triple Revolution" Lecturer: W. H. Ferry, Vice-President, Center for the Study of Democratic Institutions. Speed: 7.5. Time: 50 min. The clash of 18th Century idealism and 20th Century Institutions. What new patterns of thinking are necessary for this age.

8. CAM-8

Side No. 1 - Title: "Cybernation and Industrial Relations" Lecturer: George C. Halverson, Chairman, Dept. of Industrial Relations, San Jose State College. Speed: 7.5. Time: 50 min. General discussion of factors of unemployment. Importance of human component in industrial systems.

Side No. 2 - Title: "Problems of a Changing World and the Social Context" Lecturer: Harold Hodges, Chairman, Dept. of Sociology, San Jose State College. Time: 50 min.
Culture systems, personality systems, and organizational systems. The problem of alienation.

9. CAM-9
Side No. 1 - Title: The Second Income Plan"
Lecturer: Louis Kelso, co-author The Capitalist Manifesto and The New Capitalists. Speed: 7.5. Time: 50 min.
Discusses the theory of the private property economy. Differences between actual and necessary employment. The second income plan.

Side No. 2 - Continuation of Side No. 1. Time: 50 min.

10. CAM-10
Side No. 1 - Title: "Class Discussion - Cybernation and Man"
Discussants: S. P. R. Charter and students. Speed: 7.5. Time: 50 min.
Discussion and evaluation of papers prepared by students on course topics related to their particular field of interest.

Side No. 2 - Continuation of Side No. 1. Time: 50 min.

B. Tapes Produced by the Center For The Study of Democratic Institutions, Box 4068, Santa Barbara, California

1. CSDI-37 - Title: "Labor Looks At Itself"
   Discussants: Representatives of the United Autoworkers Union, W. H. Ferry and Paul Jacobs. Speed: 3-3/4, 1/2 track. Time: 1-1/4 hours.
   Consideration of reasons for decline of union influence. Suggestions for arresting the trend.

2. CSDI-78 - Title: "The Bleak Outlook: Jobs and Machines"
   Discussants: Gerard Piel, Editor of Scientific American; Robert Theobald, Author of Free Men and Free Markets; Ralph Helstein, President, United Packing House Workers. Speed: 3-3/4. Time: 1 hour.
   The need for the redefinition of work. The inevitable changes in our economy.

3. CSDI-105 - Title: "The Quantitative Society"
   Discussion of pamphlet written by Dr. John Wilkinson. Speed: 3-3/4. Time: 1 hour.
   Will computers in fact develop minds of their own and displace man? Arguments pro and con.

4. CSDI-116 - Title: "The Technological Society"
   Discussants: Members of the Center. Speed: 3-3/4. Time: 1 hour.
   Discussion of the book, The Technological Society by Jacques Ellul.
   A generally critical examination of Ellul's views concerning the domination of mechanization and standardization over spontaneity.

5. CSDI-239 - Title: "Technology and The Unions"
   Discussant: Ralph Helstein, President, United Packing House Workers. Speed: 3-3/4. Time: 1/2 hour.
   Objectives of collective bargaining. What political methods can be used to insure sharing of profits with the unemployed.

6. CSDI-303 - Title: "Systems Science and Social Innovation"
   Discussants: Dr. Robert Arnold, Author The California Economy, 1947-1980. Trevor Thomas, CSDI. Speed: 3-3/4. Time: 45 min.
   Application of systems science toward solution of technical and social problems.

7. CSDI-310 - Title: "The Inanimate Slaves"
Discussants: Members of CSDI. Speed: 3-3/4. Time: 30 min. Dramatized discussion of the history of machine development. Various writers such as Samuel Butler, Norbert Wiener, Samuel Gompers and Karl Rogers who have written about man's confrontation of the machine are quoted.

8. CSDI-311 - Title: "The Machine Universe" - Part III of "The Machine Image" Presented by members of the Center. Speed: 3-3/4. Time: 30 min.
Dramatic readings from many writers of the past and present on the working man's relationship with the machine.

10. CSDI-313 - Title: "The New Breed" - Part IV of "The Machine Image" Presented by members of the Center. Speed: 3-3/4. Time: 30 min. The changing nature of the structure of employment in society, resulting from cybernation.

11. CSDI-314 - Title: "The War Machine" - Part V of "The Machine Image" Presented by members of the Center. Speed: 3-3/4. Time: 30 min. Quotations from the past and present relating technological development to militaristic demands.

12. CSDI-315 - Title: "The City of the Sun" - Part VI of "The Machine Image" Presented by members of the Center. Speed: 3-3/4. Time: 30 min. Quotations from writers of the past and present who have written about Utopias and relation between work and leisure.

C. Tapes Produced by Canadian Broadcasting Corporation, Released by Dr. Robert Theobald, 400 Central Park West, New York, N. Y. 10025

1. "Preservation of Human Values in a Technological Environment," Theobald.
   Overall view of man's increasing power over his environment, the drives this creates and the policies necessary to preserve human values in technological surroundings.

2. "What Can the Computer Do?" Robert Davis, head of Learning Service, Michigan State Univ.
   Study of areas of computer take-over, potential, and significance in shaping man's self image.

3. "Technological Change and the Immediate Future," Donald Michael, fellow of the Institute for Policy Studies.
   Examination of the consequences of shifts in employment patterns due to increased competition of machine systems.

4. "Politics and Poetry," Arthur Waskow, fellow of the Institute for Policy Studies.
   Explores some of the areas in which the search for new forms of meaningful experience will be fruitful as machine-systems advance.

5. "Education for Freedom," Frank Tannenbaum, Professor Emeritus and Director of the University Seminars at Columbia Univ.
   Educational patterns in the cybernated era will not be career oriented: what changes will be required.

6. "How Will You Obtain Resources?" Theobald.
   What changes will occur when jobs are no longer available at lower levels and when available work can be less and less structured in terms of a "job."

7. "The Rich Get Rich and the Poor Get Poorer," Vera Micheles Dean, Professor at New York Univ.
   Wealth distribution is favoring industrialized nations more and more: what developments would suffice to aid underdeveloped countries?

8. "International Relations - the Use of Force," Walter Millis, Center for the Study of Democratic Institutions, and Arthur Larson, Director of the Rule of Law Research Center at Duke University.
   Major war using available weaponry would be disastrous. Study of developments of future peace efforts.

9. "Transportation Problems in a Cybernated Era," Martin Whol, National Science Foundation Faculty Fellow at the Univ. of California.
Where should man concentrate his efforts in transportation development to afford greatest possible convenience?

10. "Understanding Media," Marshall McLuhan, Director of the Center for Culture and Technology at the Univ. of Toronto.
Impact of new electronic technologies upon man's understanding of himself.

11. "Man's Knowledge of Himself," Oscar Hechter, Worcester Foundation for Experimental Biology, and Louis Linn, Lecturer in the Division of Community Psychiatry at Columbia Univ.
Explores the limits of "improvement" of man through biological, psychological and medical research.

12. "Man's Power to Control His Environment," Edward Higbee, Research Director of Study of America's Public Environment at the University of Rhode Island.
Man is now dependent upon his intelligence for survival. Explores how to create a synthetic environment and educate men to live in it.

13. "Your Role in Tomorrow's World," Jean Scott, consultant and writer.
Examination of changes in family life patterns with respect to the degree of choice to be afforded the individual.

VII. FILM AND VIDEOTAPE REFERENCES

There are films and videotapes produced by a number of different organizations which offer interesting and informative accounts of many aspects of automation and computers. One of the best catalogs of films of this kind has been prepared by the Data Processing Management Association, 505 Busse Highway, Park Ridge, Illinois 60068, under the title, Audio-Visual Aids for Data Processing Systems and Automation.

Films listed on this source and others are described below. Each of the films is available for loan or rental, and a source for ordering is given with each film. In some instances, the source given is the film library closest to San Jose State College. Your own audio-visual department may be able to locate a copy of the same film at a source nearer to you.

A. Rental or Loan Films

1. The ADA Story
   An automatic data acquisition network system which can accumulate data for batch processing while allowing instant access from over 200 remote inquiry stations.
   16 mm, sound, color, 25 min.
   Lockheed Missile and Space Co., Sunnyvale, Calif.

2. Adam Project
   Describes the Adam System and its capabilities. Also shows how alternate designs for the man-machine interaction aspects of command information can be studied and evaluated without reprogramming an experimental system.
   16 mm, sound,
   U. S. Air Force

3. APT
Film describing the Automatically Programmed Tool System, developed by M.I.T. Electronic Systems Lab.
16 mm, sound, 30 min.
Massachusetts Institute of Technology, Electronic Systems Lab,
Cambridge 39, Mass.

4. Area of Action
Award winning film showing how nations in the Far East are turning to electronic data processing to increase business efficiency.
16 mm, sound, color, 29 min.
IBM Corp., Film Library, 618 South Michigan Ave., Chicago, Ill. 60605

5. This is Automation
Gives many examples of automation and shows how it increases productivity. Produced by General Electric.
16 mm, sound, color, 30 min.
University of Georgia Film Library, Center for Continuing Education,
Athens, Georgia

6. Automatic Machines (Massachusetts Institute of Technology)
A print of a 1955 CBS-TV program providing a tour of laboratories pioneering the development of a variety of automatic machines. Interviews with Norbert Wiener, Calude Shannon, President Kilian of M.I.T.
16 mm, sound, 28 min.
McGraw-Hill Book Co., Text-Film Dept., 330 West 42nd St.,
New York 36, N. Y.

7. Automation
From "See It Now" TV series. Explores problems connected with automation in many industries. Edward R. Murrow interviews, among others, Walter Reuther, Thomas J. Watson, Jr., and M.I.T. Professor, Gordon Brown.
In three parts, each 28 min., 16 mm, sound
Mc-Graw-Hill Book Co. (address above)

8. Automation: The Next Revolution
Workers and employers discuss the serious social and economic problems of automation in this film from a CBS-TV series. J. Willard Wirtz and Ralph Helstein are among those interviewed.
16 mm, sound, 28 min.
Mc-Graw-Hill Book Co. (address above)

9. Automation in Air Traffic Control
Shows detailed data processing procedures involved in a typical flight from Boston, Mass. to Washington, D. C.
16 mm, sound, color, 11 min.
Univac Div., Sperry-Rand Corp., Film Library, 1290 Avenue of Americas, New York, N. Y. 10019

10. Automania
Through animation, Halas and Batchelor's award-winning film imaginatively spoofs the wonders of automation.
16 mm, color, 10 min.
Contemporary Films, Inc., 1211 Polk St., San Francisco, Calif.

11. Automatic Information Retrieval
Describes how a technical literature research system, developed at G.E. Flight Propulsion Division, can search through thousands of documents and retrieve information in a matter of minutes.
16 mm, sound, color, 13 min.
General Electric Company, Flight Propulsion Division, Cincinnati 15, Ohio.

12. The Bank
This film is a detailed presentation of Demand Deposit Accounting using the Programmed Applications Library approach on the 1419/1401 Tape System.
16 mm, sound, color, 19 min.
IBM Corp., Film Library (address above)

13. Base and Place
Presents the characteristics, history, and applications of binary system. Emphasizes the basic principles of base and place in our system of numeration. Shows how numbers are represented in the binary system, its relationship to electronic digital computers, and how business applies the binary system.
16 mm, sound, black and white, 30 min.
University of California, Film Library Supply, University Extension, 2272 Union Street, Berkeley, Calif. 94720

14. Blind Reader
Dr. John Linsill at Stanford, developing a device to help the blind to read.
color, 7 min.
Stanford Electronics Lab, Stanford University, California

14. . . . A Better Way! (With Data Processing)
Some unique applications of data processing equipment . . . about people who had a problem and found ". . . a better way" to solve it. For adult audiences, college and senior high school groups.
16 mm, sound, color, 30 min.
IBM Corp., Film Library (address above)

15. By The Numbers
The story of how visual images are converted into numbers so that they can be interpreted by computers. Describes the application of converting serial photographs into detailed maps by using image processing technology.
16 mm, sound, color, 16 min.
IBM Corp., Film Library (address above)

16. Can The Earth Provide
Will science be able to feed mankind.
16 mm, sound, 28 min.
McGraw-Hill (address above)

17. Census '60
An explanation of why and how United States Census data is collected, compiled and evaluated using FOSDIC (Film Optical Sensing Device for Input to Computers) and the UNIVAC 1105 Scientific Computer.
16 mm, sound, black and white, 13 min.
Univac Div., Sperry Rand Corp. (address above)

18. Child of the Future
In this National Film Board of Canada production, Dr. Marshall McLuhan discusses problems facing education as schools and colleges attempt to utilize technology for more effective teaching.
16 mm, sound, 59 min.
National Film Board of Canada, 680 Fifth Avenue, Suite 819,
New York, N. Y. 10019

19. Cern 66
Summarizes cooperative efforts of thirteen European nations in conducting research into the structure of matter. Shows how the computer is used to record, measure and analyze research data.
16 mm, sound, 20 min.
Control Data Corp., 8100 - 34th Ave., South Minneapolis, Minn.

20. The Computer Comes To Marketing

This film uses the device of a "committee" of marketing executives who have been delegated to investigate potential benefits to their own company if it should get a computer. They report to each other on what they find out in the course of a broad study of computer use by other companies.
16 mm, sound, black and white, 29 min.
Mr. R. C. Hattersley, Fortune Films, Rockefeller Center,
New York 20, N. Y.

21. Computer Programming

A 1958 film produced by SDC and filmed by UPA, on basic programming: what it is about, what the programmer does, how and why he does it. A good film to show to logically-minded prospective programmers or those interested in knowing what a programmer does. It is now somewhat dated.
16 mm, sound, black and white, 26 min.
System Development Corp., 2500 Colorado Ave., Santa Monica, Calif.

22. The Computer and the Mind of Man

A basic introduction to computers. Dr. Richard C. Haming, Research Mathematician at Bell Telephone Laboratories, discusses the computer revolution. Dr. Ernest Nagel, a leading logician and philosopher at Columbia University, talks about the relationship of man and machine and the relationship of the symbolic world of mathematics to the real world of objects and events.
16 mm, sound, black and white, 30 min.
N.E.T. Film Service, A. V. Center, Indiana University, Bloomington, Indiana.

23. Computers and Human Behavior

The use of the electronic digital computer for research in studying man's mental processes is very new. The psychologist in working with this machine seeks to discover the ways in which man thinks - how he solves problems, perceives visual objects, memorizes, etc.
16 mm, sound, black and white, 30 min.
N.E.T. Film Service, Indiana University.

24. Computer Animation Examples

Excerpts from three films: 1) Complete techniques for producing animated movies; 2) Force, mass and motion instructional film; 3) Simulation of attitude control system.
16 mm, sound, 10 min.
Bell Telephone Labs (Local Office)

25. The Control Revolution
This movie shows one of the earliest non-scientific applications of computer control, the recording, storing and processing of vast data handled by the Social Security Administration. John McCarthy, Director of Data Processing at Wyman Gordon Company, describes how an industrial plant uses a computer to keep track of and to integrate information. At the Numerical Machining Corporation, computers tool delicate machine parts. At the Standard Oil Refinery, a computer control system is used to achieve continuous and automatic process control.
16 mm, sound, black and white, 30 min., rental
N.E.T., Indiana University.

26. Computer Control of a Catalytic Cracker
Shows an IBM control system, on-line to the Standard Oil Company of California's petroleum catalytic cracking unit at El Segundo, California, performing closed-loop operations. It outlines control problems and demonstrates how IBM control systems solve them. Best suited for audiences familiar with the petroleum processes involved.
16 mm, sound, color, 9 min.
IBM Corp., Film Library (address above)

27. Computer Sketchpad
An application of the TX-2 Computer, using a light pen drawing language which permits arbitrary picture elements from previously defined shapes.
16 mm, sound, 30 min.
Produced by WGBH-TV, Boston, Mass., (M.I.T.)

28. Costs That Make Sense
Demonstration of the IBM 1401 data processing system at the American Trucking Association Conference in San Francisco. It describes this motor freight application in detail. Best suited for those with a particular interest in and knowledge of the motor freight industry.
16 mm, sound, color, 15 min.
IBM Corp., Film Library (address above)

29. Data Compression
Discusses need for eliminating redundant transmission from a satellite telenote system.
16 mm, sound, 12 min.
Lockheed Missile and Space Co. (address above)

30. Decisions at Danskammer
A film report of how an IBM 1710 control system helps guide operating decisions at the Danskammer Point generator station of the Central Hudson Corporation. Best suited for audiences with a knowledge of industrial process control.
16 mm, sound, color, 10 min.
IBM Corp., Film Library (address above)

31. Digital Computer Techniques - Binary Numbers
This film explains the binary number system by means of animation. It defines the several meanings of "logic" as applied to computers, shows the difference between the decimal and binary number systems. Explains how binary numbers are constructed and how arithmetical operations are performed with them, also cites examples of code variations of the binary system.
16 mm, sound, color, 20 min.
U. S. Navy, Ninth Naval Dist., U. S. Naval Training Center, Great Lakes, Ill.

32. Digital Computer Programming
A filmed lecture on how to program information for use in a computer. Discussed is the language of the computer and the detailed way in which the computer uses the information that is fed into it.
16 mm, sound, black and white, 51 min.
Purdue University, Audio-Visual Center, West Lafayette, Indiana

33. The Disks That Are A Cylinder
This movie introduces the IBM 1301 Disk Storage and the concept of read/write heads for each data disk surface to provide cylinder-like function.
16 mm, sound, color, 10-1/2 min.
IBM Corp., Film Library (address above)

34. Digital Computer Techniques - Introduction
This film is a general introduction to the digital computers. It relates the historical origins of calculating devices, and points out the difference between analog and digital computers, discussing the principal steps involved in the solution of problems subjected to the digital computing process.
16 mm, sound, color, 20 min.
U. S. Naval Training Center, Great Lakes, Ill.

35. Digital Computer Techniques - Programming
Defines computer programming, explains what is meant by analyzing the problem; shows how a simple flow chart is prepared with symbols giving their meaning; shows by use of a simple example how instructions to the computer are encoded in computer language.
16 mm, sound, color, 14 min.
U. S. Naval Training Center, Great Lakes, Ill.

36. Digital Computer Techniques - Computer Units
Discusses, in an introductory way, the five major units of a digital computer: the Input Unit and how it reads the problem data and instructions; the Output Unit and how it delivers problem solutions in some form of output medium; the Arithmetic Unit, its composition and examples of how its basic components work; the Control Unit and the purposes of sequencing, clocking and timing.
16 mm, sound, color, 24 min.
U. S. Naval Training Center, Great Lakes, Ill.

37. Digital Computer Techniques - Logic Element Circuits
Illustrates how solid state electronics are used in modern computers. Shows diagrams for diode, circuits, the P-N-P Transistor, its use in AND, OR, NOR, INVERTER and FLIP-FLOP gates.
16 mm, sound, color, 16 min.
U. S. Naval Training Center, Great Lakes, Ill.

38. Digital Computer Techniques - Logic Symbology
Shows the basic U. S. Military Standard Symbols for the logic elements of computers as an introduction to digital computer logic symbology. The logic elements - AND, OR OR (exclusive) NOR DELAY, INVERTER, FLIP-FLOP and the way they function in handling electronic signals are shown in art.
16 mm, sound, color, 15 min.
U. S. Naval Training Center, Great Lakes, Ill.

39. Display Time Compression For Radar Tracking System
The computer is used as a central storage device for radar information which is acquired from various remote sites.
16 mm, sound, 15 min.
Mitre Corporation, Bedford, Mass.

40. EDP For Your Payroll
EDP For Your Payroll introduces a time-and-money saving miracle to those unfamiliar with Electronic Data Processing and explains both the payroll service plan and its benefits to large and small business.
16 mm, sound, color, 14 min.
Bank of America, Training Services Section, One South Van Ness Ave., San Francisco 20, Calif.

41. Engine at the Door
J. Presper Eckert, co-inventor of ENIAC and vice-president of UNIVAC Division of the Sperry Rand Corporation, poses the question: "Will machines ever run man?" Ernest Nagel, professor of philosophy at Columbia University, and Dr. C. R. DeCarlo, Director of Education for IBM, discuss the uses man makes of science and technology today.
16 mm, sound, black and white, 30 min.
N.E.T., Indiana University.

42. Electronics in Automation
This film colorfully shows many opportunities in Automation Electronics. The much-discussed "push-button plant" of the future is graphically illustrated, section by section with full color sequences showing many interesting applications of Electronic controls to production processes. Recently-developed computers and other Electronic devices, vividly shown, also explain the part Automation is expected to play in modern offices.
16 mm, sound, color, 22 min.
Devry Technical Institute, 4141 Belmont Ave., Chicago 41, Ill.

43. Electronic Computers and Applied Mathematics
To explain the basic principles and operations of electronic computers and the use of Binary Arithmetic so that number systems and the Place Value concept are more meaningful.
16 mm, sound, color, 23 min.
Bureau of Audio-Visual Instruction, Extension Division, State Univ. of Iowa, Iowa City, Iowa.

44. Electronic Computers Improve Management Control
A variety of the latest types of business machines are shown with a description of how these machines can best be utilized in designing an efficient production control system. This system is then applied to the specific problem presented in the film, illustrating how the system actually works in practice.
16 mm, sound, color, 15 min.
University of California, Public Film Rental Library Extension, 2223 Fulton St., Berkeley, California 94720.

45. Flight Simulation
A new programming approach to real-time flight simulation. Demonstrates the use of digital computers in solving complex simulation problems. The problems of safely reaching the moon and back are discussed in the film.
16 mm, sound, color, 20 min.
IBM Corp., Film Library (address above)

46. The Flow Process Chart
Explains the use of the flow process chart and flow diagram in simplifying and standardizing work operations. Stresses the importance of the job breakdown in time saving. Produced by the Library of Congress.
16 mm, sound, color, 15 min.
Audio-Visual Center, School of Business and Public Admin., City College of New York, 17 Lexington Ave., New York 10, N. Y.

47. Flow Process Chart and How to Use It
Process analysis through flow chart; application to work-simplification. Step-by-Step entries; coding by symbol; graphic development of information. Reviews complete procedure with a flow-process-chart analysis of a man shaving.
16 mm, sound, color, 15 min.
University of Michigan, Audio-Visual Education Center, Ann Arbor, Mich.

48. Introduction to Analog Computers
This two-hour, three-part technical lecture-film (approximately 40 minutes per part) by Dr. L. C. Just of Argonne's Applied Mathematics Division include: 1) components of electronic analog computers, 2) familiarization with a typical analog computer, 3) programming for analog computers, and 4) solution of typical problems.
16 mm, sound, color, 2 hours.
Bryon, Inc., 1226 Wisconsin Ave. N.W., Washington 7, D.C.

49. Introduction to Automatic Data Processing (TF 11-2552)
Discusses the automatic data processing system, explaining its underlying concept, capabilities, operations, and application as a management tool. Shows several systems currently in use in federal government installations.
16 mm, sound, black and white, 31 min., free.
Fifth Army, Central Film Exchange, Fort Sheridan, Ill.

50. The Information Explosion
The purpose of this informative, but non-technical film, is to restore balance to our appraisal of the computer's true role in contemporary society: to show that the computer is the tool of man rather than the reverse. That man does the thinking which directs the computer is constantly emphasized.
16 mm, sound, color, 21 min.
Association Films, 561 Hillgrove Avenue, La Grange, Illinois.

51. Information Retrieval
The first twelve minutes of the movie describes how a theoretical but typical large company solves its communication problems by adopting modern information retrieval procedures, using conventional IBM Data Processing Systems.
16 mm, sound, color, 18 min.
IBM Corp., Film Library (address above)

52. The Information Machine
A sophisticated, sometimes amusing account of the development of the electronic computer beginning with primitive man and ending with the advent of machine simulation.
16 mm, sound, color, 10 min.
IBM Corp., Film Library (address above)

53. IBM Control Systems at Work
IBM control systems are shown guiding a fractional distillation unit at the American Oil Company in Whiting, Indiana, and a blast furnace operation at the Inland Steel Company in Hammond, Indiana.
16 mm, sound, black and white, 5 min.
IBM Corp., Film Library (address above)

54. IBM at The World's Fair
A tour through the IBM Pavilion at the New York World's Fair, highlighting the People Wall which takes visitors on a trip up into the Information Machine theatre. Also shown are sequences from several puppet shows featured inside the Pavilion, as well as the automatic language translation and character recognition exhibits.
16 mm, sound, color, 5-1/2 min.
IBM Corp., Film Library (address above)

55. Innsbruck - Tokyo 1964
Using animation, this film traces the history and development of the Olympic Games. We are introduced to the 1964 Winter and Summer Games, with a detailed explanation of how results of the various events will be collected, computed, and then immediately disseminated around the world in record time.
16 mm, sound, color, 9 min.
IBM Corp., Film Library (address above)

56. Input/Output Structure of the American Economy
Describes a technique which, with the computers and data banks now accessible, provides a powerful planning tool for industrial management. Featured are Secretary of Commerce, John Connor; Professor Wassily Leontief and Gerard Piel. Of primary interest to economists.
16 mm, sound, color, 40 min.
Scientific American, 415 Madison Ave., New York, N. Y. 10017

57. Inquiry
Explains the role of data processing equipment in key functions of government and society. Reviews day-to-day activities of the United States Air Force, and shows the role played by data processing in the successful fulfillment of the Air Force's global responsibilities. For adult audiences, college and senior high school groups.
16 mm, sound, color, 17 min.
IBM Corp., Film Library (address above)

58. Introduction to Feedback
Feedback--the cycle of measuring, evaluating and correcting--has become a science and an art. We are shown its growing importance in our daily life. Best suited for audiences with some interest in science and technology.
16 mm, sound, color, 11-1/2 min.
IBM Corp., Film Library (address above)

59. The Living Machine
In two half-hour films THE LIVING MACHINE explores the progress already made in electronics technology and the new frontiers of knowledge and experience that these man-made machines will open to man himself.
16 mm, sound, black and white, Part 1 - 29 min., Part 2 - 30 min.
National Film Board of Canada (address above)

60. Machines That Think
Research at Argonne National Laboratories into the future scientific use of computers is shown in this presentation which stresses non-numerical manipulation of symbols. Computers interpret significance of patterns such as spark chamber photographs, and control laboratory experimental apparatus.
16 mm, sound
Audio-Visual Branch, Div. of Public Information, U. S. Atomic Energy Commission, Washington, D. C. 20345

61. Magnetic Tapes
An account of how IBM tests magnetic tape products before releasing them for shipment to customers. Relates rigid specifications to the need for quality tape in a data processing installation.
16 mm, sound, color, 11-1/2 min.
IBM Corp., Film Library (address above)

62. Mark of Man
A study of the ways man has used data processing from ancient times to the present.
16 mm, sound, color, 10 min.
Electronics Div., General Dynamics Corp., San Diego, Calif.

63. Managers and Models
Design and simulation capabilities of the modern computer are explored. The importance of mathematical models in the translation of a model of a Saturn Rocket into numerical terms, and the place of computers in the design and testing of the booster stage is discussed.
16 mm, sound, black and white, 30 min., rental.
N.E.T., Indiana University

64. Mass Information Control
The story of RCA's 3488 mass random access computer equipment.
16 mm, sound, color, 12 min.
Radio Corp. of America, Electronic Data Processing Sales Dept., Camden, N. J. 18101

65. Memory Devices
This film shows information storage devices used in modern computing machine memories and explains how binary information is stored in them. Basic concepts and terms are explained and examples of mechanical, electro-mechanical, magnetic, electrostatic and photographic memories are described.
16 mm, sound, black and white, 28 min.
Bell Telephone Co.

66. Methods Analysis
The use of methods analysis to reduce production costs is described. The work of the job analyst and of the time study engineer is also shown through the study of the manufacturing cycle. Produced by McGraw-Hill Book Company, the film can be correlated with their textbook, "Industrial Organization and Management" by Bethel, Atwater, Stackman, and Smith.
16 mm, sound, black and white, 10 min.
Colorado Univ., Bureau of Audio-Visual Instruction, Stadium 348, Boulder, Colo.

67. New Paths to Learning
How one community faces the information explosion is shown in the program at Michigan's Oakland Community College which offers a system's approach to education.
16 mm, sound, color, 13 min.
Litton Industries, Beverly Hills, Calif.

68. A Numerically Controlled Machine Tool
A lucid exposition of the basic principles of numerical control of machine tools. The film describes the first numerically controlled machine tool, developed in 1952 by the M.I.T. Servo-mechanisms Lab, under sponsorship from the U. S. Air Force.
16 mm, sound, black and white, 20 min.
Massachusetts Institute of Technology, Electronic Systems Lab, Cambridge 39, Mass.

69. OAO - Eye in Space
Tells through animation the story of the Orbiting Astronomical Laboratory . . . a telescope in space gathering information to be processed by computers on earth.
16 mm, sound, 9 min.
IBM Corp., Film Library

70. Office in the Sky
Story of flight training for air crew members of one of the country's largest airlines.
16 mm, sound, 26 min.
United Air Lines

71. Of Men and Machines
An introduction to engineering psychology. The use of technology in psychological research. With Dr. Paul Fitts, Univ. of Michigan; Dr. Julian Christiansen, Wright Air Development Center; and Dr. George Briggs, Ohio State Univ.
16 mm, sound, 30 min.
National Educational Television, 10 Columbus Cir., N. Y. 19, N.Y.

72. Of Time, Work and Leisure
Based on Sebastian de Grazia's book, explores the nature and problems of leisure.
16 mm, sound, 29 min.
N.E.T., Washington State Univ., Pullman, Washington

73. One Step Behind - One Step Ahead
An operational description of how the computer-based New York State Identification and Intelligence System will serve the functions of police, correction and parole agencies.
16 mm, sound, 28 min.
System Development Corp. (address above)

74. Once Upon A Punched Card
An easy-to-understand explanation of the basic principles of punched card accounting.
16 mm, sound, color, 9 min.
IBM Corp., Film Library

75. Pert Cost
The film was produced to show project managers, engineers, and controllers how to apply PERT to any complex project.
16 mm, sound, color, 27 min.
Industrial Education Films, Inc., 196 Nassau St., Princeton, N.J. 08540

76. Principles of Electronic Data Processing
A complete discussion of the basic principles of electronic data processing is embodied in this movie. It explains the provisions for input, storage, processing and output of data at the speed of light, and in infinitesimal space. It touches on such things as punched cards, paper and magnetic tape, magnetic ink, magnetic core, drum, disk and tape storage, central processing and console control.
16 mm, sound, color, 16 min.
IBM Corp., Film Library

77. Productivity: Key to Plenty
Warns that continued prosperity depends on our uninterrupted technological progress and use of basic sources of power. An Encyclopedia-Britannica Film.
16 mm, sound, 30 min.
University of California, University Extension (address above)

78. Process Charts
The film shows a thorough analysis of a specific work operation, (setting a dinner table at home), how a process chart is made, and how work can be simplified systematically through its use.
16 mm, sound, black and white, 16 min., rental
Bureau of Audio-Visual Instruction, State University of Iowa, Iowa City, Iowa

79. Programming Languages
Systems Development Corporation - A semi-animated film designed as an introduction to programming languages in computer-oriented systems. It touches upon the evolution of the new SDC compiler language called JOVIAL.
16 mm, sound, color, 5 min.
System Development Corp. (address above)

80. Push Buttons and People
(United Automobile Workers) Presents the role that automation is assuming and will play in our society. Walter Reuther, President of the U.A.W., stages labor's position on the automation issue and the benefits and disadvantages of automation.
16 mm, sound, black and white, 22 min.
Audio-Visual Center, School of Business and Public Administration, City College of New York, 17 Lexington Ave., New York 12, N.Y.

81. Quality Control
Factors in setting quality standards, effects of higher or lower quality standards on manufacturing cost and selling price. Correlated with Bethel, Atwater, Smith and Stackman: Industrial Organization and Management.
10 min.
Pennsylvania State Univ., Audio-Visual Aids Library, University Park, Penna.

82. The Question Tree
An examination of man's age-old curiosity concerning the world around him . . . and where this curiosity has led him. The story of how intelligent questioning leads to scientific discovery. Includes sequences on cryogenics, language translation, vapor growth and optical maser.
16 mm and 35 mm, sound, color, 13 min.
IBM Corp., Film Library

83. Responsiveness in Data Processing Systems
Discusses problems which can occur with an improperly designed data processing system.
16 mm, sound, 24 min.
Burroughs Corp., Detroit, Mich. 48232

84. Rush Hour - Space Age
Shows how certain major communities are utilizing tools of science and technology to vesture balance to their transit system.
16 mm, sound, 18 min.
Litton Industries, Beverly Hills, Calif.

85. The School Information Center
This film tells the story of how data processing equipment in a secondary school system can make more time available for the prime process of teaching, and more facts available for student counseling.
16 mm, color, 12 min.
IBM Corp., Film Library

86. SDC's Automated Teaching Project
Designed as an informal interview, the film briefs viewers on the nature and potentials of computer-oriented instruction developed at SDC with a complete system approach for administrators, counselors, teachers, and students.
16 mm, sound, color, 14 min.
System Development Corp. (address above)

87. Selective Dissemination of Information
The purpose of this film is to describe the operation of Selective Dissemination of Information which is currently in use at the IBM Advanced Systems Development Division at the Mohansic Laboratory.
16 mm, sound, color, 5 min.
IBM Corp., Film Library

88. Small Miracle
Covers such varied subjects as highway design, shoe retailing and teaching.
16 mm, sound, 14 min.
IBM Corp., Film Library

89. Space Age Administration
Portrays key role of electronic data processing in the administrative management of 500,000 air reservists. Scenes of daily operation at Air Reserve Records Center depict numerous complicated tasks accomplished through the modern magic of electronics.
16 mm, sound, color, 19 min.
U. S. Air Force Film Library, 8900 South Broadway, St. Louis, Mo. 63125

90. Symbolic Control
Describes how symbolic control of the machine is ushering in a new era in design and use of machine tools.
16 mm, sound, 16 min.
Illinois Institute of Technology, Research Institute

91. To Hare Is Human
Bugs Bunny fights for his life against the coyote and his computer.
16 mm, sound, color, 8 min.
Univac Div., Sperry Rand Corp. (address above)

92. Time Sharing
A description of the time sharing program system developed at System Development Corporation.
16 mm, sound, black and white, 30 min.
Western Electric (Local Telephone Office)

93. Then and Now
An account of the development of ENIAC the first electronic computer, by J. Presper Eckert and Dr. John W. Mauchly, Co-Inventors of the system. Following their account of ENIAC, Mr. Eckert and Dr. Mauchly discuss their current interests and activities.
16 mm, sound, color, 12 min.
Univac Div., Sperry Rand Corp. (address above)

94. The Teaching Machine - A Psychological Experiment
Science measures the learning process. Dr. B. F. Skinner at Harvard's Psychology Laboratories with Dr. R. J. Herrenstein uncovers important knowledge about the process of behavior.
16 mm, sound, black and white, 27 min.
Hamilton Film Service, 245 West 55th St., New York 19, N. Y.

95. The Thinking Machine
From the October, 1960 CBS-TV series, "Tomorrow," with Actor David Wayne and top scientists, you see a TV play written by a computer, watch a computer learn as a child learns, and see a computer playing checkers. Dr. Jerome Wiesner of M.I.T. introduces frontiers in brain and computer research. Other authorities include: Dr. Claude Shannon, Dr. Jerome Y. Lettvin, and Dr. Douglas Rose, all of M.I.T., Prof. H. A. Simon of Carnegie Institute of Technology, Dr. Arthur Samuel of IBM and others.
16 mm, sound, black and white, 54 min.
Association Films, 561 Hillgrove Ave., La Grange, Ill.

96. "Thinking" Machines
Approaches and experiments in machine intelligence, with Claude Shannon of M.I.T., Alex Bernstein of IBM, and Leon Harmon of Bell Laboratories.
16 mm, sound, color, 20 min., rental, $2.00-#7, $5.00-#17, $6.00-#24

97. Tomorrow
Problems of ethics involved in automation. United Church of Christ.
16 mm, sound, 30 min.
Univ. of California Extension Center (address above)

98. Tomorrow . . . Today
A graphic illustration of how electronic data processing is speeding economic development and educational progress in Latin America. The film depicts the advances already being made in Costa Rica, Peru, Mexico, Brazil and Argentina.
16 mm, sound, color, 28 min.
IBM Corp., Film Library

99. Treasures of the Earth
Shows how computers, lasers and other advance equipment are used to discover natural resources on land and beneath the sea.
16 mm, sound, 18 min.
Litton Industries

100. Trial Balance
Shows primarily through animation, the scientific achievements of NASA's space program.
16 mm, sound, 25 min.
National Aero. and Space Admin.

101. Universe
A journey through space and into the solar system.
16 mm, sound, 30 min.
National Film Board of Canada (address above)

102. Universal Machine
Why the computer can be called a "Universal Machine." Dr. C. R. DeCarlo, Director of Education for IBM, comments on the computer revolution. Introduction to programming languages such as FORTRAN, Flow-matic, and ALGOL.
16 mm, sound, black and white, 30 min.
N.E.T., Indiana Univ.

103. Universe of Numbers
The history of computer development from the first mechanical calculator invented by Blaise Pascal in the 17th Century to ENIAC, the first completely electronic calculator built in the mid-1940's by John Mauchly and J. Presper Eckert.
16 mm, sound, black and white, 30 min.
N.E.T., Indiana Univ.

104. A Voice in Business
Shows how a corporation communicates with its stockholders, how stockholders vote on important issues, and results of this voting at one company's annual meeting.
16 mm, sound, black and white, 13-1/2 min.
IBM Corp., Film Library

105. What Do You Want
Traces the development of electronic computers from ENIAC to UNIVAC III.
16 mm, sound, color, 20 min.
Univac Div., Sperry Rand Corp. (address above)

106. What Is EDP? (Principles of EDP)
Discussion of the basic principles of electronic data processing. Explains input, storage, processing and output of data. Deals briefly with punched cards, paper and magnetic tape, magnetic ink, and magnetic drum, disk and tape storage.
16 mm, sound, color, 13 min.
IBM Corp., Film Library

B. Videotapes

Computer fundamentals from a quasi-historic procedure and organization-oriented viewpoint, a joint effort of Committee on Computers in Engineering Education, American Society for Engineering Education and The Academic Computer Center and Instructional Television Center, United States Military Academy.

1. Finger Counting by Machine, Or . . . Historic Development of Computing Machinery. Tape 1D 117D1. Duration: 17 min. A concept-oriented description of the history of computers divides history into three areas: mathematical machines, business machines and electronics. Mathematical history described includes Finger Counting, Abacus, Pascal's Calculator, Leibnitz' Calculator, Colmar's Arithmometer, Babbage's Difference Engine, Jacquard's Loom and Babbage's Analytic Engine. Business-type punched card machines described include Hollerith's 1890 system and pre-World War I punched card systems are shown. Early electromechanical/electronic computers include ZUSE, Aiken's Mark I, ENIAC & EDVAC. Reliability problems with early vacuum tube computers. Well-seasoned punched card equipment reorganized into computer like organization save the day - the IBM CPC.

2. How To Get Frenchmen To Work, Or . . . The Development of Mechanistic Computing Procedures. Tape 1D 117D2. Duration: 12 min. Norbert Weiner's concept of the 2nd Industrial Revolution: Machines replacing men's minds in performance of routine mental tasks. Just as in the 1st Industrial Revolution machines replaced men's muscles in performance of routine physical tasks. Babbage's 1823 concept of "division of mental labor," Prony's method of preparing mathematical tables with large numbers of unskilled persons. 1st Section: Analysts; 2nd Section: Technician/Coders; 3rd Section: Computation. Same methods are used today with computers except 3rd section instead of being 80+100 people off the streets of Paris is today an electronic computer. Analysis of functions performed by 3rd section: input, arithmetic, instruction and worksheet (memory), output and clerk himself (control). As each unit is described fade-in/fade-out to corresponding part of an electronic computer.

3. Money Makes Money, Or . . . Analysis of a Problem for Computer Solution. Tape 1D 117D3. Duration: 18 min. Logical patterns of analysis in education: Scientific Method, Estimate of the Situation, Formal Military Staff Study. Developing procedures for problem solution which are so specific and so exact that they can be performed by a machine. One breakdown of steps which can be used for this kind of problem solution: 1) Recognize the problem; 2) Define the problem exactly; 3) Analyze and choose a method of attack; 4) Develop a step-by-step procedure for solution (usually shown in graphic flow-chart form); 5) Coding (conversion to a computer language); 6) Preparation of test and live data; 7) Performance of solution by computer; and 8) Evaluation of results. Uses compound interest problem as an example. Emphasizes ability when computer is used to go back to basic definitions of task to be done applied over and over instead of using complex, compound interest formulas. Indicates industrial engineering history and mnemonic symbol shapes of flow chart. Symbols program shown in two languages: an easy-read dialect of FORTRAN and an assembly language. (Program details not explained.) Considerable emphasis on use of test data to validate procedure and evaluation of results first with test data and then with live data.

4. How To Drive a Clerk Nuts, Or . . . Problem Solution by a Clerk Using Computer-Type Instructions. Tape 1D 117D4. Duration: 14 min. Reviews fundamental units of clerical problem-solving system. FORTRAN instructions are used by a clerk who uses this system to perform solution as a step-by-step rote process in response to instructions. Cards are read, information is copied to worksheet (memory), computations are performed with historic desk calculator shown in program 1, results are copied to answer sheet, etc. Emphasis is given to rote response of clerk to instructions and of "mechanical" nature of process and the fact that clerk used a computer language to solve the problem. Responsibility of problem analyst is emphasized, but job of clerk is described as so routine as to be potentially degrading. Indicates that function of clerk is to be taken over by a machine - a computer.

5. A New Foreign Language - Computerese, Or . . . Translation To Internal Computer Language. Tape 1D 117D5. Duration: 12 min. Computer takes over what Babbage called "one of the lowest operations of human intellect." Close analogy of computer to clerical system shown by means of computer simulator with five fundamental units. Fade-in fade-out to actual parts of real computer. Emphasis on control unit indicates simplification of electronic device which can be achieved

by restricting instruction format to simple verb-object form such as RCD YR (Read CarD containing YeaR) or the even more abbreviated numeric form 25 120, where 25 is a numeric code indicating RCD and 120 is a number permanently assigned to a particular physical location in memory. Translation from relatively free format of FORTRAN to this more restrictive format accomplished by human in TV program and indicated as sufficiently straightforward that it could be accomplished by computer program called a compiler. TV program describes translation of first part of sample compound interest problem used in previous program showing how a FORTRAN instruction may generate more than one of the restricted-format machine-oriented instructions. Brief description/rationalization of how memory is assigned. Program is set up and stored in computer-simulator memory ready for demonstration of computer-simulator equivalent of clerk's operation for actual problem solution run in a computer.

6. By The Numbers - Compute, Or . . . Solution of a Problem on a Computer Simulator. Tape 1D 117D6. Duration: 17 min.
   This program shows step-by-step the flow of information inside a computer in a "typical problem solution." It strongly emphasizes the fact that program and data are stored in computer memory, and introduces such ideas of loading a program before execution begins, the fetch-execute cycle of operation during problem solution, and the functions of program counter and instruction register in determining the sequence of operations and the specific functions to be performed. The viewpoint is not so much to emphasize these as "technical material" as to show that the operations are so basic and straightforward as to be mechanical and therefore implementable either mechanically - as porposed by Babbage - or electronically, a much more suitable choice with today's technology.

7. The Electrons Go Round and Round and the Answer Comes Out Here, Or . . . Solution of a Problem on the Computer. Tape 1D 117D7. Duration: 17 min.
   This program takes the viewer into the Academic Computer Center to view the solution of the compound interest problem on the computer. The two steps of compilation (translation to machine language) and performance of the solution are described and shown, first in a fashion typical of small computer installations which do not have magnetic tape, then with a magnetic tape computer using a system monitor. Attention then shifts to solution from a remote terminal which is connected to the system only by a telephone line. A final wrap up shows the growth of computer capabilities in both memory capacity and speed

which has been occurring in the past quarter century and strongly emphasizes that in spite of these remarkable capabilities the computer is no "magic box," but a device performs human-developed human-specified problem-solving procedures at electronic speeds and thereby relieves human beings of routine work - work which in some cases might be so lengthy as to be impractical.

BIBLIOGRAPHY

There can be no such thing as a definitive bibliography in this subject, ranging widely as it does across many fields of knowledge. Every week there are many new articles and books which relate to the concerns of man in an age of cybernation. In preparing the bibliography, it was determined to try and refer mainly to publications of the last several years, except for certain basic titles, and to produce a working reference list which would be of help to anyone who might wish to develop a course similar to ours. It should be noted that many of the titles which are listed under a given topic heading, might equally well have appeared under another.

CYBERNATION AND SOCIETY - General Readings

American Assembly. *Automation and Technological Change.* Edited by John T. Dunlop. Prentice-Hall, 1962.

Background papers and the final report of the 21st American Assembly at Arden House, New York, May 3-6, 1962. The impact of technology in its educational, social, psychological, organizational, managerial, and economic aspects, in perspective by leaders in their fields.

Bronowski, J. *Science and Human Values*. Harper and Row, 1964.

A revised and enlarged edition of an often-quoted essay. A new dialogue, "The Abacus and the Rose," originally broadcast by the B.B.C. in 1962, discussing the theme that science is as integral a part of the culture of our age as the arts are, is included.

Columbia University, Seminar on Technology and Social Change. *Technology and Social Change*. Edited by Eli Ginzberg. Columbia University Press, 1964.

Following each of five papers presented at the seminar (here reprinted), Professor Ginsberg ably describes the conflicting views held by the economists, political scientists, sociologists, engineers, historians, philosophers, government administrators, and business men discussing the numerous topics dealt with under technology and social change.

Diebold, John. "The New World Coming," Saturday Review, July 23, 1966, pp. 17-18.

The variety of today's computers and man-computer interfaces, and the new fields of Data Utilities (as a Public Utility) and Information Technology, are described.

Ellul, Jaques. The Technological Society. Translated from the French by John Wilkinson. Introduction by Robert K. Merton. Knopf, 1964.

The dismal prospect of a society increasingly collectivized, enslaved, and dehumanized by techniques now possible is the theme of this book. His observations are sometimes insightful, sometimes demonstrably incorrect.

Mumford, Lewis. Technics and Civilization. Harcourt, Brace and World, 1963. bibl.

An historical and critical account of the effect of the artificial environment on man, and of man on the environment. The method is a discussion of social significance of key inventions; the result is a fascinating type of history.

Philipson, Morris, editor. Automation: Implications for the Future. Vintage Books, 1962.

Eighteen contributors look at the many aspects of automation, and automation's implications for: theory; industry; labor; the social sciences; government; education; leisure.

Scientific American. Issue on "Information," Vol. 215, No. 3 (September 1966).

Contents - "Information" by John McCarthy; "Computer Logic and Memory" by David C. Evans; "Computer Inputs and Outputs" by Ivan E. Sutherland; "Systems Analysis and Programming" by Christopher Strachey; "Time-sharing on Computers" by R. M. Fano and R. J. Corbato; "The Transmission of Computer Data" by John R. Pierce; "The Uses of Computers in Technology" by Steven A. Coons; "The Uses of Computers in Organizations" by Martin Greenberger.

General reference sources particularly useful for further information are:

Current Sociology, 1952-date. Quarterly.

Essay and General Literature Index, 1937-date. Updated by supplements.

The Reader's Guide to Periodical Literature, 1900-date. Semi-monthly (July, August monthly.)

Social Sciences and Humanities Index, 1907-date. Quarterly.

Sociological Abstracts, 1952-date. Eight issues per year.

Other significant readings:

Aldon, Robert S. Automation in Banking. Rutgers University Press, 1963.

Allen, F. R., et al. Technology and Social Change. Appleton-Century-Crofts, 1957.

Asbell, Bernard. The New Improved American. McGraw-Hill, 1965.

Bagrit, Sir Leon. The Age of Automation. Mentor Books, 1963.

Battelle-American Assembly, Columbus, Ohio, 1963. Automation and Technological Change; Proceedings of the Battelle-American Assembly, May 9-11, 1963. Battelle Memorial Institute, 1963.

Bittel, Lester R., et al. Practical Automation. McGraw-Hill, 1957.

Blough, Roger M. "Security in an Age of Technological Change," Advanced Management Journal, Vol. 29, No. 2 (April 1964) pp. 22-28.

Brady, R. Organization, Automation and Society. University of California Press, 1961.

Buckingham, Walter. "Automation - Its Impact on People," Advanced Management Journal, Vol. 29, No. 2 (April 1964) pp. 29-33.

Bunge, Mario. "Technology as Applied Science," Technology and Culture, Vol. 7, No. 3 (Summer 1966).

Campus Dialogue; Voice of Campus Dialogue on the Individual in the Community of the Future. Robert Theobald, Campus Coordinator, Denison University, Granville, Ohio. Vol. 1 (1965-1966), Vol. 2 (1966-1967).

Chase, Stuart. Men and Machines. Macmillan, 1937.

Charter, S. P. R. "Man, Machines and Morality," Man on Earth, Vol. 1, No. 3, 1965.

Coogan, Joseph P. "From the Psychopolitical Path to War," Change, Vol. 2, No. 4, 1966.

Cook, Clair M. "Technology Impact on Religion," The Christian Century, Vol. 81 (September 2, 1964) pp. 1083-1085.

Cousins, Norman. "Hail Automation, Hail Peace," Advanced Management Journal, Vol. 29, No. 2 (April 1964) pp. 99-100.

Davis, Charles T. "Humanistic Imperatives in an Age of Technology," Pennsylvania Library Association, Bulletin, Vol. 21, (August 1965). 5 pp.

Davis, K. "Urbanization of the Human Population," Scientific American, Vol. 213 (September 1965) pp. 40-53.

Diebold, John. Automation; The Advent of the Automatic Factory. Van Nostrand, 1952.

_______________. "Automation; Perceiving the Magnitude of the Problem," Advanced Management Journal, Vol. 29, No. 2 (April 1964) pp. 29-33.

_______________. Beyond Automation. McGraw-Hill, 1962.

Drebee, Carl. Automation; What it is; How it works; Who can use it. Norton, 1957.

"The Dynamics of Change," Kaiser Aluminum News, February, (1966).

"Epochal Change," Duns Review, Vol. 85 (April 1965) p. 37 ff.

Feedback. New York: The Institute for Cybercultural Research, Inc., 1964-date. Published 10 times per year, some issues combined. Includes "The Cybercultural Review; A Quarterly of Cybernetics and Society," Feedback, Vol. 4, Nos. 3-4.

Feibleman, James K. "Technology as Skills," Technology and Culture, Vol. 7, No. 3 (Summer 1966).

Fuller, R. Buckminster. Ideas and Integrities. Prentice-Hall, 1963.

______. "Vision 65; Summary Lecture," The American Scholar, Vol. 35, No. 2 (Spring 1966) pp. 206-232.

George, Frank H. Automation, Cybernetics and Society. Philosophical Library, 1959.

Giedion, Siegfried. Mechanization Takes Command. Oxford University Press, 1948.

Goldberg, Maxwell H. "The Impact of Technological Change on the Humanities," The Educational Record, Vol. 46 (Fall 1965) pp. 388-399.

Goushev, Sergei, editor. Russian Science in the 21st Century. McGraw-Hill, 1960.

Grabbe, Eugene Munter. Automation in Business and Industry. Wiley, 1957.

Harvard University. Program on Technology and Society. First Annual Report of the Executive Director, April 28, 1964-June 30, 1965. Cambridge, Massachusetts, 1965.

Hawley, George F. Automating the Manufacturing Process. Reinholt, 1959.

Heckscher, August. "The Individual and the Mass," The Twentieth Century Fund, 1965.

Hertzler, Joyce Oramel. The History of Utopian Thought. Cooper Square, 1950.

Hilton, Alice Mary. The Evolving Society. The Institute for Cybercultural Research, 1966.

______. "The Role of the Church in a Changing Society," Feedback, Vol. 3, Nos. 2-3 (November-December 1965).

______. "The Story of Civilization; Man's Search for Labour-saving Devices," Mind, Vol. 59, 1950.

Hoos, Ida R. Automation in the Office. Public Affairs Press, 1961.

Hugh-Jones, Edward Maurice, editor. The Push-Button World; Automation Today. University of Oklahoma Press, 1956.

Institute on Man and Society, New York. That Man May Survive. Rensselaerville, 1965.

Juenger, Friedrich Georg. The Failure of Technology. Gateway Books, 1949.

Kateb, George. Utopia and Its Enemies. Glencoe Free Press, 1963.

Killian, James R., Jr. "Lift the Human Spirit! Excerpts from an Address," Saturday Review, Vol. 48 (May 1, 1965) pp. 58-60.

Kranzberg, Melvin. "Technology and Human Values," The Virginia Quarterly Review, Vol. 40, No. 4 (Autumn 1964) pp. 578-592.

Lewis, Arthur O., Jr. Of Men and Machines. Dutton, 1963.

Lilley, Samuel. Automation and Social Progress. International Publishers, 1957.

Lundberg, Ferdinand. The Coming World Transformation. Doubleday, 1963.

Man on Earth; a Periodical of Writings on Human Ecology: Man's interrelationship with his total environment. S. P. R. Charter, editor. Contact, 1964- . Intermittent.

Marcuse, H. One-Dimensional Man. Beacon, 1964.

Mayo, Elton. The Human Problems of an Industrial Civilization. Macmillan, 1933.

Mentzer, William C. "The Next 40 Years," Mainliner, Vol. 10, No. 4 (April 1966) pp. 10-12.

Mesthene, Emmanuel G. "On Understanding Change; The Harvard University Program on Technology and Society," Technology and Culture, Vol. 6, No. 2 (Spring 1965) pp. 222-236.

Meyer, J. R., et al. The Urban Transportation Problem. Harvard University Press, 1965. bibl.

Michael, Donald N. Cybernation; The Silent Conquest. Center for the Study of Democratic Institutions, Santa Barbara, Calif., 1962.

______________. "Speculations on the Relation of the Computer to Individual Freedom and the Right to Privacy," George Washington Law Review, Vol. 33 (January 1965).

Morse, Dean, and A. W. Warner, editors. Technological Innovation and Society. Columbia University Press, 1966.

Mumford, Lewis. "Authoritarian and Democratic Technics," Technology and Culture, Vol. 5, (Winter 1964) pp. 1-8.

______________. "Technics and the Nature of Man," Technology and Culture, Vol. 7, No. 3 (Summer 1966).

______________. The Transformations of Man. Harper, 1956.

New York University, Institute of Philosophy. Dimensions of Mind; A Symposium. New York University Press, 1960.

Niland, Powell. Management Problems in the Acquisition of Special Automatic Equipment. Harvard University Press, 1961.

Olsen, Arnold. "Automation - Friend or Foe?" Advanced Management Journal, Vol. 29, No. 2 (April 1964) pp. 39-44.

Pyke, Magnus. Automation; Its Purpose and Future. Philosophical Library, 1957.

Revans, R. W. "The Pathology of Automation," Advanced Management Journal, Vol. 29, No. 2 (April 1964) pp. 12-21.

Rogers, Jack. Automation; Technology's New Face. University of California press, 1958.

Ross, Howard R. "New Transportation Technology," International Science and Technology, No. 59 (November 1966) pp. 26-37.

Schuh, J. F. Principles of Automation. Van Nostrand, 1965.

Seidman, Harold. "What the Federal Government is Doing to Improve Manpower Control and Utilization in the Face of a Changing Technology," Advanced Management Journal, Vol. 29, No. 2 (April 1964) pp. 91-93.

Shiles, Edward B. Automation and Industrial Relations. Holt-Reinhart and Winston, 1963.

Silberman, Charles E. The Myth of Automation. Harper, 1966.

Society for Applied Anthropology. Man and Automation. Yale University Press, 1956.

Somers, G. G. Adjusting to Technological Change. Harper and Row, 1963.

Technology and Culture; The International Quarterly of the Society for the History of Technology. Melvin Kranzberg, editor-in-chief. University of Chicago Press, 1964-date. "Current bibliography in the history of technology," Jack Goodwin, compiler. Winter issue, 1964. Spring issues, 1965-date.

Teilhard de Chardin, Pierre. The Future of Man. Translated from the French by Norman Denny. Harper and Row, 1964.

Theobald, Robert. "The Great Non-Debate on Automation and Cybernation," Discussion Group 10 (What are the pressures on Higher Education from present and impending revolutions in cybernetics and automation,) 20th National Conference on Higher Education, Association for Higher Education, Chicago, March 8, 1965.

______________. "Human Rights in a Cybernated Age," Educational Record, Vol. 45 (Spring 1964) pp. 113-121.

Tillich, Paul. "The Person in a Technical Society," The Christian Faith and Social Action, edited by John A. Hutchison. Scribner's, 1953.

Trachtenberg, Alan. "Technology and Human Values," Technology and Culture, Vol. 5 (Summer, 1964). 18 pp.

U. S. Congress. House. Committee on Science and Astronautics. Panel on Science and Technology; Government, Science and Public Policy. Proceedings of Sub-committee, 89th Congress, 2nd sess., January 25-27, 1966. U. S. Govt. Print. Off., 1966.

U. S. Department of Labor. Bureau of Labor Statistics. Automatic Technology and Its Implications; A Selected Annotated Bibliography. Prepared by Edgar Weinberg. U. S. Govt. Print. Off., 1956.

U. S. Library of Congress. Conference on Libraries and Automation. Airlie Foundation, May 26-30, 1963. Edited by Barbara Evans Markuson. U. S. Library of Congress, 1964.

U. S. President's Advisory Committee on Labor-Management Policy. The Benefits and Problems Incident to Automation and Other Technological Advances. Report dated January 11, 1962. U. S. Govt. Print. Off., 1962.

U. S. Smithsonian Institution. Annual Report, 1953. "The Push-Button Factory," by Frank K. Shallenberger. U.S. Govt. Print. Off., 1953.

Von Neumann, John. "Can We Survive Technology?" Fortune, Vol. 51, (June 1955) pp. 106-108+

Walker, Charles R. Modern Technology and Civilization; An Introduction to Human Problems in the Machine Age. McGraw-Hill, 1962.

______________. Toward the Automatic Factory. Yale University Press, 1957.

Watson, Thomas J. "Technology," Think, Vol. 26 (December 1960)

Weeks, Robert P., editor. Machines and the Man; A Source Book on Automation. Appleton-Century-Crofts, 1961.

Wiener, Norbert. Human Use of Human Beings; Cybernation and Society. Anchor Books, 1954.

Wohlsteter, A. "Technology, Prediction and Disorder," Bulletin of the Atomic Scientists, Vol. 20 (October 1964) pp. 11-15.

Woods, H. D., editor. Industrial Relations and Technological Changes. McGill University Press, 1957.

"Worlds and Beyond," Trajectory, Vol. 3, No. 1 (Fall 1963) pp. 46-51.

GENERAL SYSTEMS AND SYSTEMS THEORY

Boguslaw, Robert. The New Utopians; A Study of System Design and Social Change. Prentice-Hall, 1965. bibl.

For whom and for what are the Utopias designed by systems engineers and social engineers of our time to be? Value questions ignored by system designers in their consideration for hardware and automated equipment are raised here with regard to present time and in the future, when, "population will be wagged increasingly by their technological tails."

Kuhn, Alfred. The Study of Society; A Unified Approach. R. D. Irwin, 1963.

A cybernetic, or general systems, approach to economics, sociology, and political science. The major claim that a meaningful analysis of society can be carried out with a limited number of concepts which cut across conventional disciplinary boundaries seem successfully established.

Simon, Herbert A. The Shape of Automation for Men and Management. Harper and Row, 1965.

Organizations are seen as large and complex dynamic systems of various man-and-machine combinations. This analysis of management's role in decision making, and the computer's function in contributing to the role, is a reasoned rebuttal to the prophets of doom and gloom of an increasing automated society.

General reference sources particularly useful for further information are:

Business Periodicals Index, 1958-date. Monthly.

Psychological Abstracts, 1927-date. Monthly.

Public Affairs Information Service. Bulletin, 1915-date. Weekly.

Social Sciences and Humanities Index, 1907-date. Quarterly.

Sociological Abstracts, 1952-date. Eight issues per year.

Other significant readings:

American Management Association. Office Management Division. Organizing for Effective Systems Planning and Control. American Management Association, 1956.

Case Institute of Technology. Systems Symposium, 1963. Edited by Mihajlo D. Mesarovic. Wiley, 1964.

Conway, R. W. "Some Tactical Problems in Digital Simulation," Management Science, Vol. 10 (October 1963).

Dorf, Richard C., Time Domain Analysis and Design of Control Systems. Addison-Wesley, Reading, 1965.

Jones, Richard W. "An Engineer Looks at Physiology," Science, Vol. 140 (May 3, 1963) pp. 461-464.

Kaplan, Morton A. System and Process in International Politics. Wiley, 1957.

Laden, Hyman Nathaniel, and T. R. Gildersleeve. System Design for Computer Applications. Wiley, 1963.

McMillan, Claude, and Richard F. Gonzalez. System Analysis; A Computer Approach to Decision Models. Irwin, 1965. bibl.

Marquis, Stewart D. Bibliography on Systems. (Bibliography Series, No. 7, Institute for Community Development and Services.) Michigan State University, 1963.

Marx, Melvin Herman, and William A. Hillix. Systems and Theories in Psychology. McGraw-Hill, 1963. bibl.

Optner, Stanford L. Systems Analysis for Business and Industrial Problem Solving. Prentice-Hall, 1965.

Plischke, Elmer. Systems of Integrating the International Community. Van Nostrand, 1964.

Quade, Edward S., editor. Analysis for Military Decisions. Rand McNally, 1964.

Smith, O. J. Feedback Control Systems. McGraw-Hill, 1958.

Society for General Systems Research. Yearbook, 1956-date. Ann Arbor, Michigan, 1956-date.

Tilles, Seymour. "Manager's Job; A Systems Approach," Harvard Business Review, Vol. 41 (January 1963) pp. 73-81. bibl.

Tocher, K. D. The Art of Simulation. English Universities Press, Ltd., 1963.

Watkins, H. D. "California Effort is Key to Growth Area," Aviation, Vol. 84 (January 31, 1966).

Yovits, Marshall C. Conference on Self Organizing Systems. 2nd. Proceedings of the Conference on Self-Organizing Systems, May 22-24, 1962, Chicago. Spartan Books, 1962.

COMPUTERS, CYBERNETICS AND COMMUNICATION

Bell, David Arthur. Intelligent Machines; An Introduction to Cybernetics. Blaisdell, 1962.

A brief semi-technical account of elementary cybernetics, divided into four parts; information theory as far as comments on Maxwell's Demon and Shannon's Coding System; control theory as far as simple examples of negative feedback; basic computing machinery of digital and analog varieties; and the use of cybernetic notions to represent simple neutral nets and economic systems.

Feigenbaum, Edward A., et al, editors. Computers and Thought. McGraw-Hill, 1963. bibl.

A collection of articles, research reports and discussions, concerned with the information processing activity that underlies intelligent behavior in human beings and in computers. The articles are grouped for interest to, a) the general reader; b) the computer scientist and the management scientist; and, c) the psychologist and the philosopher.

McLuhan, Marshall. Understanding Media; The Extensions of Man. McGraw-Hill, 1964.

In spite of a tendency toward intellectual magalomania, this unusual book gives a fresh, original view of the influence of the mass media, very broadly considered, on modern society.

Pierce, J. R. Symbols, Signals and Noise; The Nature and Process of Communication. Edited by James R. Newman. Harper and Row, 1961.

This account of communication (or information theory) by the Director of Research in Communication at Bell Telephone Laboratories uses a simplified mathematical approach, and includes chapters on communication theory in relation to arts and psychology.

General reference sources particularly useful for further information are:

Applied Science and Technology Index, 1958-date. Ten issues/year.

Chemical Abstracts, 1907-date. Bimonthly.

Engineering Index, 1906-date. Monthly bulletins.

Psychological Abstracts, 1906-date. Monthly.

Reader's Guide to Periodical Literature, 1900-date. Semi-monthly (July, August, monthly.)

Other significant readings:

Alt, F. A., and M. Rubinoff. Advances in Computers, Vol. 6. Academic Press, 1965.

Apter, Michael J. Cybernetics and Development. Pergamon, 1966.

Arbib, Michael A. Brains, Machines and Mathematics. McGraw, 1964.

Ashby, W. R. An Introduction to Cybernetics. Wiley, 1956.

Auerback, Isaac L., et al. "The Information Revolution," New York Times, Section II, May 23, 1965 (Special supplement.)

Bar-hillel, Y. Language and Information. Addison Wesley, 1964.

Beer, Stafford. Cybernetics and Management. Wiley, 1959.

Berkeley, Edmund C. The Computer Revolution. Doubleday, 1962.

______________. Giant Brains. Science Editions, 1949. bibl.

Berlo, David Kenneth. Process of Communication. Holt, Rinehart and Winston, 1960. bibl.

Bernstein, Jeremy. The Analytical Engine; Computers: Past, Present and Future. Random House, 1964.

Booth, Andrew D. Automation and Computing. Macmillan, 1959.

Britton, Karl. Communication. L. Paul, Trench, Trubner & Co., 1939.

Bronowski, J. "Review of Brains, Machines and Mathematics, by Michael A. Arbib," Scientific American, Vol. 210 (June 1964) pp. 130-134.

Burck, Gilbert, et al. The Computer Age and Its Potential for Management. Harper and Row, 1965.

Cady, Edwin Laird. Creative Communication. Reinhold, 1956.

Carpenter, Edmund, and Marshall McLuhan, editors. Explorations in Communication; An Anthology. Beacon Press, 1960.

Ceccato, Silvio. "Cybernetics as a Discipline and an Interdiscipline," Diogenes, Nos. 53 (Spring 1966).

Chapanis, Alphonse. Man-Machine Engineering. Wadsworth, 1965.

Chase, Stuart. Power of Words. Harcourt, Brace, 1954. bibl.

Cherry, Colin. On Human Communication. The M.I.T. Press, 1957.

Cleator, Phillip E. The Robot Era. Crowell, 1955.

Congress of Industrial Organizations. The Challenge of Automation. Public Affairs Press, 1955.

Culbertson, James Thomas. The Minds of Robots; Sense Data, Memory Images, and Behavior in Conscious Automata. University of Illinois Press, 1963. bibl.

David, Edward E., Jr. "Sharing a Computer," International Science and Technology, (June 1966) pp. 38-47.

Dexter, Lewis Anthony, and David Manning White, editors. People, Society and Mass Communications. Glencoe Free Press, 1964. bibl.

Duncan, Hugh D. Communication and Social Order. Bedminster Press, 1962. bibl.

Eisenson, John, J. Jeffrey Auer, and John V. Irwin. The Psychology of Communication. Appleton-Century-Crofts, 1963.

"Engineering Psychology Explores Man and Machine," The Stevens Indicator, Vol. 2, No. 5 (May 1966).

Fabre, Maurice. A History of Communication. Adapted from the French by Peter Chaitin. Hawthorn Books, 1963.

Kegel, Charles H., and Martin Stevens. Communication; Principles and Practice. Wadsworth, 1959.

Lathi, B. P. Signals, Systems and Communication. Wiley, 1965.

Latil, Pierre de. Thinking by Machine; A Study of Cybernetics. Houghton-Mifflin, 1957.

Leondes, Cornelius T. Computer Control Systems Technology. McGraw-Hill, 1961.

McCracken Daniel D. A Guide to Fortran IV Programming. Wiley, 1965.

Mack, Raymond W., and Dennis C. McElrath. "A Computerized View of the World," (Series: The Study of Man) Transaction, Vol. 2 (January-February, 1965) pp. 27-28.

Maruyama, Magoroh. "Cybernetics," National Education Association Journal, Vol. 53 (December 1964) pp. 51-56.

Michel, Joseph. Human Communication and General Semantics. New Voices, 1958.

"Minos II - A Trainable Pattern-Recognizing Machine," Stanford Research Institute Journal, (September 1965), pp. 6-9.

Modern Language Association. Literary Data Processing Conference, September 9-11, 1964. Jess B. Bessinger, et al, editors. Modern Language Association, 1964.

Moore, Robert E. Automation in Business Communication. Vision, Inc., 1957.

National Association of Educational Broadcasters. Improvement of Teaching by Television. Proceedings of the National Conference of the National Association of Educational Broadcasters at the University of Missouri, March 2-4, 1964. University of Missouri Press, 1964.

Pask, Gordon. An Approach to Cybernetics. Harper, 1961.

Reitman, Walter R. Cognition and Thought; An Information-Processing Approach. Wiley, 1965. bibl.

Robinson, Enders A. Random Wavelets and Cybernetic Systems. Hafner, 1962.

Rosenblatt, Frank. The Perceptron. Cornell University Press, 1958.

Rothstein, Jerome. Communication, Organization and Science. Falcon Wing Press, 1958.

Savas, Emanuel S. Computer Control of Industrial Processes. McGraw-Hill, 1965. bibl.

Schramm, Wilber Lang. The Science of Communication. Basic Books, 1963.

Scientific American. Automatic Control. 1955.

Singiko, H., editor. Selected Papers on Human Factors in the Design and Use of Control Systems. Dover, 1961.

Sluckin, Vladyslaw. Minds and Machines. Revised edition. Penguin Books, 1960. bibl.

Smith, O. J. Feedback Control Systems. McGraw-Hill, 1958.

Southworth, Raymond, et al. Digital Computation and Numerical Methods. McGraw-Hill, 1965.

Stumpers, Franz Louis Henri Marie. A Bibliography of Information Theory, Communication Theory, Cybernetics. Research Laboratory of Electronics, Massachusetts Institute of Technology, 1953.

Teddington, England. National Physical Laboratory, Autonomics Division. International Conference on Machine Translation of Languages and Applied Language Analysis. H. M. Stationery Office, 1962.

Time Magazine. "The Computer in Society," April 2, 1965.

Tsien, S. Engineering Cybernetics. McGraw-Hill, 1954.

U. S. Joint Publications Research Service. 22d All-Union Scientific Session Devoted to Radio Day. Section on Theory of Information, August 9, 1966. (TT:66-33340) Clearinghouse, U. S. Dept. of Commerce, 1966.

U. S. Science Advisory Committee. Science, Government and Information; The Responsibilities of the Technical Community and the Government in the Transfer of Information. January 10, 1963. The White House, 1963. (The now-classic Weinberg Report.)

Von Neumannn, John. The Computer and the Brain. Yale University Press, 1958.

Wasserman, Paul. The Librarian and the Machine. Gale Research Co., 1965.

Weber, Edward. "The New Empires in Data Processing," Advanced Management Journal, Vol. 29, No. 2 (April 2, 1964) pp. 75-79.

Wiener, Norbert. Cybernetics. Second edition. M.I.T. Press, 1961.

______________. God and Golem, Incorporated. M.I.T. Press, 1964.

Whiteman, Irvin R. "New Computer Languages," International Science and Technology, (April 1966) pp. 62-68.

Wozencraft, John M., and Irwin Mark Jacobs. Principles of Communication Engineering. Wiley, 1965. bibl.

CYBERNATION, LABOR AND LEISURE

deGrazia, Sebastian. Of Time, Work, Leisure. Anchor Books, 1962.

The history of leisure and work both as ideal and as practiced. The sharp differences between the classical Greek ideal of leisure and the modern industrial American view are noted. The author espouses and writes from the classicist's point of view.

Dulles, Foster Rhea. A History of Recreation; America Learns to Play. Second edition. Appleton-Century-Crofts, 1965. bibl.

Recreation, historically and current; "The changing Scene" and "The New Leisure," all in a valuable and deft survey of an almost uncontrollable subject.

General reference sources particularly useful for further information are:

The New York Times Index, 1913-date. Semi-monthly.

Psychological Abstracts, 1927-date. Monthly.

Public Affairs Information Service. Bulletin, 1915-date. Weekly.

Reader's Guide to Periodical Literature, 1900-date. Semi-monthly (July, August monthly.)

Social Sciences and Humanities Index, 1907-date. Quarterly.

Vital Speeches of the Day, 1934-date. Monthly.

Other significant readings:

Adler, Mortimer J. "Labor, Leisure and Liberal Education," Journal of General Education, Vol. 6 (October 1951) pp. 35-45.

Amber, George, and Paul S. Amber. Anatomy of Automation. Prentice-Hall, 1962, bibl.

Anderson, Nels. Work and Leisure. Free Press of Glencoe, 1961.

______________. Dimensions of Work; The Sociology of a Work Culture. D. McKay Co., 1964.

Azrael, Jeremy R. "Notes on Soviet Urban Attitudes Towards Leisure," *Social Problems,* Vol. 9, No. 1 (Summer 1961).

Barkin, Solomon. "Discussion of the Shortening Work Week," *American Economic Review,* Vol. 46 (May 1956) pp. 218-231.

Bendiner, Robert. "Could You Stand a Four-Day Week?" *The Reporter Magazine,* Vol. 17 (August 8, 1957) pp. 10-14.

Brightbill, Charles K. *The Challenge of Leisure.* Prentice-Hall, 1960.

______________. *Man and Leisure*. Prentice-Hall, 1961.

Buckingham, Walter. *Automation; Its Impact on Business and People.* Mentor, 1961.

Butler, George Daniel. "The Structures of Public Leisure Agencies," *American Academy of Political and Social Science, Annals*, Vol. 313, 1957.

Charlesworth, James C. "A Bold Program for Recreation," *American Academy of Political and Social Science, Annals*, Vol. 313, 1957.

______________. "Leisure in America; Blessing or Curse?", *American Academy of Political and Social Science, Annals,* April 1964.

Cissel, R., and H. Cissel. "Automation and Jobs," *America*, (April 3, 1965) pp. 459-461.

Dale, E. L., Jr. "Great Unemployment Fallacy," *New Republic,* (September 1964) pp. 10-12.

Decker, Kenneth. "Can We Predict Recreation's Future?", *Journal of Physical Education, Health and Recreation*, March 1955.

Douglass, Paul F. "People, Power and Leisure," *Recreation*, Vol. 46A (April 1953) pp. 210-212.

______________. "Learning to Live With Leisure Time," *American Recreation Journal. Annual*, 1960.

Drucker, Peter F. *The Future of Industrial Man.* Mentor Books, 1942.

Faltermayer, Edmund K. "The Drift to Early Retirement," *Fortune*, Vol. 71, (May 1965) pp. 112-115+

Friedmann, Georges. *The Anatomy of Work, Labor, Leisure, and the Implication of Automation*. Free Press of Glencoe, 1964.

Friedmann, Georges. *The Industrial Society*. Glencoe Free Press, 1955. bibl.

Ginzberg, Eli. "Automation and Minority Manpower; Challenge to Management," *Advanced Management Journal*, Vol. 29 (April 1964) pp. 70-74.

Green, Arnold W. *Recreation, Leisure and Politics.* McGraw-Hill, 1964.

Hall, Helen. "The Leisured Society," *Harvard Business Review*, Vol. 37, No. 3 (May-June 1959).

Havemann, Ernest. "Too Much Leisure," *Life Magazine*, Vol. 56 (February 14, and February 21, 1964).

Helstein, Ralph, Gerard Piel, and Robert Theobald. *Jobs, Machines and People*. Center for the Study of Democratic Institutions, Santa Barbara, 1964.

Huxley, Aldous Leonard. "Education for Leisure," *American Federationist*, Vol. 36, 1929.

International Brotherhood of Pulp, Sulphite and Paper Mill Workers. *Automation; Economic Implications and Impact Upon Collective Bargaining*. Second edition. June, 1964.

Larrabee, Eric, and Rolf Meyerjohn, editors. *Mass Leisure.* Free Press of Glencoe, 1958.

________________. "Time to Kill, Automation, Leisure and Jobs," *Nation* (September 20, 1965) pp. 198-202.

Lee, Robert. *Religion and Leisure in America*. Abingdon Press, 1964.

McDonald, D. J. "Automation and Full Employment," *Vital Speeches of the Day*, (April 15, 1964) pp. 409-512.

Mann, Floyd C. *Automation and the Worker.* Holt, 1960.

Moustakas, Clark E. *Loneliness.* Prentice-Hall, 1961.

Miller, N. and D. Robinson. The Leisure Age. Wadsworth, 1964.

Murrell, K. F. H. Human Performance in Industry. Reinhold, 1964. bibl.

Pieper, Josef. Leisure - The Basis of Culture. Pantheon Books, 1952.

Raskin, A. H. "Automation; Road to Lifetime Jobs?" Saturday Review, Vol. 47 (November 28, 1964) pp. 14-16+

Rideau, Emile. "Theology of Leisure," Theology Digest, Vol. 12 (Fall 1964).

Rosenberg, J. Automation, Manpower and Education, Random House, 1966.

Russell, Bertrand. In Praise of Idleness and Other Essays. Fourth edition. George Allen and Unwin, Ltd., 1954.

Soule, George. "The Economics of Leisure," American Academy of Political and Social Science, Annals, Vol. 313 (1957).

Stern, J. L. "Automation; End of a New Day in Unionism," American Academy of Political and Social Science, Annals, Vol. 150 (Nov. 1963)

Swados, Harvey. "Less Work - Less Leisure," Nation (February 22, 1958).

"Technological Dilemma," Nation (April 26, 1965) p. 435.

Toffler, Alvin. The Culture Consumer. St. Martin's Press, 1964.

U. S. Bureau of Labor Statistics. "Manpower Implications of Technological Change," Monthly Labor Review (February 1965) pp. 3-4.

Vikomere, Ahtik. "The Social Planning of Leisure," International Social Science Journal, Vol. 12 (November 1960). UNESCO.

Wilensky, Harold. "Labor and Leisure; Intellectual Traditions," Industrial Relations; A Journal of Economy and Society, Vol. 1, No. 2 (February 1962).

_______________. "The Uneven Distribution of Leisure; The Impact of Economic Growth on 'Free Time,'" Social Problems, Vol. 9, No. 1 (Summer 1961).

HISTORY OF TECHNOLOGY

Klemm, Friedrich. History of Western Technology. Translated by Dorothea W. Singer. Scribner, 1959. bibl.

An anthology compiled from the literature relating to technology. Selections from the writings of economists and philosophers as well as scientists and technicians are divided into seven major sections. It begins with the classical Greek-Roman era, and ends with 20th Century technology.

Morison, Elting E. Men, Machines and Modern Times. The M.I.T. Press, 1966.

A collection of essays that explore several ways in which man has brought much of the natural environment under his control, then questions man's ability to control the system he has created. Mr. Morison's final proposal is to start all future experiments with man as the great criterion.

Singer, Charles Joseph, et al, editors. History of Technology. 5 Volumes. Clarendon Press, 1954-1960.

Each chapter is written by a specialist, yet the quality of the editing is so high that there is more coherence and unity than is usually found in multi-authored works. Volume 4, The Industrial Revolution, covers ca. 1750 to ca. 1850. Volume 5, The Late Nineteenth Century, covers ca. 1850 to ca. 1900, and the outstanding theme is the importance of applied science.

General reference sources particularly useful for further information are:

Historical Abstracts, 1775-1945, 1955-date. Quarterly.

Nuclear Science Abstracts, 1948-date.

Social Sciences and Humanities Index, 1907-date. Quarterly.

and the periodical,

Technology and Culture; The International Quarterly of the Society for the History of Technology, 1959-date.

Other significant readings:

Armytage, W. H. G. *A Social History of Engineering*. The M.I.T. Press, 1966.

Booker, P. J., Wailes, R. et al, *The Machine Heritage*, The Institute of Mechanical Engineers, London, 1963.

Burlingame, Roger. *Machines That Built America*. Signet Books, 1953.

Derry, T. K., and T. I. Williams. *A Short History of Technology*. Oxford Press, 1960.

Finch, James Kip. *Engineering and Western Civilization.* McGraw, 1951.

Foster, G. M. *Traditional Cultures and the Impact of Technological Change.* Harper, 1962.

Goodwin, Jack, compiler. "Current Bibliography in the History of Technology," Technology and Culture, Vol. 5, No. 1 (Winter 1964), Vol. 6, No. 2 (Spring 1965), Vol. 7, No. 2 (Spring 1966).

Hall, Courtney Robert. *History of American Industrial Science.* Library Publications, 1954.

Heald, Morrell. *Technology in American Culture*. Delano, Florida, 1962.

Keller, A. G. *A Theatre of Machines*. Macmillan, 1965.

Mantoux, P. *The Industrial Revolution in the 18th Century*. Second revised edition. Macmillan, 1961.

Marcus, Abraham. *Power Unlimited.* Prentice-Hall, 1959.

Smith, Elliott Dunlap, and R. C. Nyman. *Technology and Labor; A Study of the Human Problems of Labor-Saving.* Yale University Press, 1939.

Soulard, R. *A History of the Machine*. Hawthorn, 1963.

Somers, G. G. *Adjusting to Technological Change.* Harper and Row, 1963.

Strehl, R. *The Robots Are Among Us.* Arco, 1955.

CYBERNATION AND ECONOMICS

Galbraith, John Kenneth. The Affluent Society. Houghton-Mifflin, 1958.

This book does more than illuminate economics for the non-economist; it causes us to consider most carefully whether the qualities of our affluent society's economic fabric are appropriate for present day elements. The author shows how existing economic ideas were fashioned for a world very different from our own; thus, the present humorless preoccupation with goods, and an increasingly frantic effort to manufacture "wants" as rapidly as "products."

Kelso, Louis O., and Mortimer Jerome Adler. The New Capitalists; A Proposal to Free Economic Growth From the Slavery of Savings. Random House, 1961.

A proposal for a Capitalist Diffusion Insurance Corporation to eliminate savings, or the ownership of existing capital, as an indispensable prerequisite to investment. An interesting, challenging, and imaginative speculation to reverse the trend toward socialism and build a capitalist economy that would work for individual freedom.

Lebergott, Stanley, editor. Men Without Work; The Economics of Unemployment. Prentice-Hall, 1964. bibl.

This collection of essays surveys the background of the problems of unemployment and the outlook for possible solutions. Many skeins of economic opinion are effectively drawn together in this collection of current thinking by leading American economists on the misuse and under-utilization of that all-too-important natural resource - manpower.

Meier, Richard L. Science and Economic Development; New Pattersn of Living. Second edition. The M.I.T. Press, 1956.

A provocative appraisal, and synthesis, of what is most promising in contemporary science and technology for world development. New paths for economic development are traced.

Theobald, Robert. The Challenge of Abundance. Mentor, 1962. bibl.

An examination of the dangers and opportunities presented by our new economy of abundance. The chief danger is our persistent reliance upon economic and social ideas based on conditions of scarcity that are rapidly disappearing. Foreign economic and political relations are also examined.

Weisbrod, Burton A., editor. The Economics of Poverty; An American Paradox. Prentice-Hall, 1965. bibl.

A collection of short selections on poverty, none of which favor it, none opposed to government action to alleviate it. The major debate on the Alleviation Program's effect on freedom of consumer choice is given a balanced airing. The leading names in the poverty dialogue are represented in this collection that excels in balance between emotion and research, conservative and liberal approach.

General reference sources particularly useful for further information are:

Business Periodicals, Index, 1958-date. Monthly.

Economic Abstracts, 1953-date. Bimonthly.

New York Times Index, 1913-date. Semi-monthly.

Public Affairs Information Service. Bulletin, 1915-date. Weekly.

Wall Street Journal Index, 1958-date. Monthly.

Other significant readings are:

The Ad Hoc Committee on the Triple Revolution. The Triple Revolution. Santa Barbara, California, March 22, 1964.

Alderson, W., and S. J. Shapiro. Marketing and the Computer. Prentice-Hall, 1963.

Bright, James R. "Opportunity and Threat in Technological Change," Harvard Business Review, Vol. 41 (November/December, 1963) pp. 76-86.

Brooks, T. R. "Managing Your Manpower; Effects of Automation," Duns Review and Modern Industry (May 1964) pp. 71-72.

Buckingham, Walter. Automation, Capital Equipment and Economic Progress. Kester-Dana Corp., 1964.

Business Automation, 1958-date. Issue of January 1966.

Chinitz, Benjamin, editor. City and Suburb; The Economics of Metropolitan Growth. Prentice-Hall, 1964.

"The Dynamics of Change," *Kaiser Aluminum News,* No. 1, 1966.

Einzig, Paul. *The Economic Consequences of Automation.* Norton, 1957.

Farber, Joseph. "The Individual Subsidy Plan," *Feedback,* Vol. 4, Nos. 1-2 (January, February 1966).

Fein, Louis. "From the P.I. Bill of Rights; A New Weapon in the War on Poverty and Welfare, and a New Way of Allocating Purchasing Power in the Automating Society," *Signs of Change,* Vol. 2 (1966) p. 5.

Fitzgerald, E. B. "Industry and the Technological Revolution," *Vital Speeches of the Day,* Vol. 30 (August 15, 1964) pp. 659-662.

Hurd, Cuthbert C. "Automation and Management," *Advanced Management Journal,* Vol. 29, No. 2 (April 1964) pp. 7-11.

Juvinall, Andrew. "Ten Corporations and Automation," *Christian Century,* Vol. 82 (March 3, 1965) pp. 27-1273.

Kelso, Louis O., and Mortimer J. Adler. *The Capitalist Manifesto.* Random House, 1958.

Kozmetsky, George, and Paul Kircher. *Electronic Computers and Management Control.* McGraw-Hill, 1956.

Loomba, Rajindra P. *Engineering Unemployment; Whose Responsibility?* San Jose State College, Engineering Division. (1963) bibl.

McDonald, David J. "A Labor-Management Approach to Change," *Advanced Management Journal,* Vol. 29, No. 2 (April 1964) pp. 51-56.

Moller, George. "Will Management in Smaller Companies Keep Pace with Automation?" *Advanced Management Journal,* Vol. 29, No. 2 (April 1964) pp. 45-50.

Mossman, Frank H., and Newton Morton. *Logistics of Distribution Systems.* Allyn and Bacon, 1965. bibl.

Page, Edward I. "The Reversed Economic Impact of Automation," *Advanced Management Journal,* Vol. 29, No. 2 (April 1964) pp. 94-98.

Piel, Gerard. "Abundance and the Future Man," Atlantic Monthly, Vol. 213 (April 1964).

"Poverty and Profits," by L. Merle Hostetler, Louis O. Kelso, Norton E. Long, and James F. Oates, Jr. Harvard Business Review, September/October, 1964.

Rezler, Julius. "Managerial Functions in the Era of Automation," Advanced Management Journal, Vol. 29, No. 2 (April 1964) pp. 57-66.

Shilis, Edward. "The Management of Industrial Relations Problems Stemming From Automation," Advanced Management Journal, Vol. 29, No. 2 (April 1964) pp. 80-90.

Silberman, Charles E. "The Real News About Automation," Fortune, Vol. 71 (January 1965) pp. 124-126. Also, (March 1965) pp. 78+.

Shostak, Arthur B., and William Gomberg, editors. New Perspectives on Poverty. Prentice-Hall, 1965. bibl.

Theobald, Robert. Free Men and Free Markets. Doubleday, 1965.

______________, editor. The Guaranteed Income; Next Step in Economic Evolution? Doubleday, 1966.

CYBERNATION, POLITICS AND THE SOCIAL SCIENCES

Banks, Arthur S. and R. B. Textor. A Cross-Polity Survey. The M.I.T. Press, 1963.

In this unique adaptation of the "cross-cultural" method to comparative politics, a computer is used to compare all of the 115 independent governments in the world. The report includes: methodology; the raw and finished characteristic code sheet; finished characteristic code sheet.

Borko, Harold, editor. Computer Applications in the Behavioral Sciences. Prentice-Hall, 1962.

Specialists present and evaluate computer applications in such fields as psychological research, statistical computation, language analysis, simulation of neuro-physiological models, and simulation of social system models.

Wiesner, Jerome B. Where Science and Politics Meet. McGraw-Hill, 1966.

The contributions that science and technology have made, and can be expected to make, to the advancement of human welfare, arms control, education needs, are all surveyed. Some legitimate misgivings about the heavy dependence of science research on Federal subsidies are, however, lightly dismissed.

General reference sources particularly useful for further information are:

Canadian Index, 1948-date. Monthly.

Public Affairs Information Service. Bulletin, 1915-date. Weekly.

Reader's Guide to Periodical Literature, 1900-date. Semi-monthly (July, August monthly.)

Social Sciences and Humanities Index, 1907-date. Quarterly.

Other significant readings:

Alcott, James. Technology and Urban Needs. Midwest Research Institute, 1966.

Association of the Bar of the City of New York. Special Committee on Radio and Television. Radio, Television and the Administration of Justice; A Documented Survey of Materials. Columbia University Press, 1965. bibl.

Burke, John G. New Technology and Human Values. Wadsworth, 1965.

Ellul, Jacques. Propaganda; The Formation of Men's Attitudes. Translated by K. Kellen and J. Lerner, Knopf, 1965. bibl.

Finlay, D. J., O. R. Holsti, and R. R. Fagen. Enemies in Politics. Rand McNally, in press.

Fite, Henry H. The Computer Challenge; To Urban Planners and State Administrators. Spartan Books, 1965.

Herber, Lewis. Crisis in Our Cities. Prentice-Hall, 1965.

Hitch, Charles J. Decision-Making for Defense. Univ. of California Press, 1965.

Helmer, Olaf. Social Technology. Basic Books, 1966.

Holsti, Ole R. "An Adaptation of the 'General Inquirer' for the Systematic Analysis of Political Documents," Behavioral Science, Vol. 9 (1964) pp. 382-388.

Miller, Arthur Selwyn. "Technology, Social Change, and the Constitution," George Washington Law Review, October 1964.

Murphey, Walter F. Wiretapping on Trial; A Case Study in the Judicial Process. Random House, 1965. bibl.

O'Toole, Thomas. "White Collar Automation," The Reporter, Vol. 29 (December 5, 1963) pp. 24-27.

Pool, Ithiel de Sola, et al. Candidates, Issues and Strategies; A Computer Simulation of the 1960 and 1964 Presidential Elections. Second edition. The M.I.T. Press, 1965.

________________. "Simulating Social Systems," International Science and Technology, March 1964, pp. 62-70.

Rosinski, Herbert. Power and Human Destiny. Edited by Richard P. Stebbins. Praeger, 1965.

Singer, J. D., editor. Quantitative International Politics. Macmillan, 1966.

Stone, P. J., D. C. Dunphy, M. S. Smith, and D. M. Ogilvie. The General Inquirer; A Computer Approach to Content Analysis in the Behavioral Sciences. The M.I.T. Press, 1966.

Wasserman, Paul, and F. S. Silander. Decision-Making; An Annotated Bibliography Supplement, 1958-1963. Cornell University, Graduate School of Business and Public Administration, 1964.

CYBERNATION, THE SCIENTIFIC PROFESSIONS, AND THE ARTS

Mumford, Lewis. Art and Technics. Columbia University Press, 1952. bibl.

Traces the relationship, throughout history, between two conflicting impulses within man: the artistic (subjective) and the technical (objective). The thesis is illustrated by showing how, in the history of painting, sculpture, architecture, and engineering, the struggle between the internal and the external forces are in alternating dominance. The Conclusion is an analysis of the present times and a final plea for a renewal of personal initiative.

Nervi, Pier Luigi. Aesthetics and Technology in Building. Translated by R. Einaudi. Harvard University Press, 1965.

Nervi's credo is that architecture is a synthesis of technology and art. Here he examines the relationship between esthetics and technology. His Port Authority Bus Terminal in New York City, and his Nathaniel Leverone Field House at Dartmouth are illustrated by photographs taken during and after construction.

Schmit, Lucien A. "Automated Design," International Science and Technology, (June 1966) pp. 63-78. bibl.

Predicting the behavior of proposed designs is routine work for digital computers. Now, they are being programmed a step beyond analysis to evaluate designs and find the one that is best. Engineering design is seen as part judgment and part logical decision-making.

General referencessources particularly useful for further information are:

Applied Science and Technology Index, 1958-date. Monthly.

Art Index, 1929-date. Quarterly.

Quarterly Cumulative Index Medicus, 1927-date. Quarterly.

Social Sciences and Humanities Index, 1907-date. Quarterly.

Technical Book Review Index, 1917-date. Monthly.

Other significant readings:

Bates, Marston. Man in Nature. Second edition. Prentice-Hall, 1964. bibl.

Broadbent, D. E. "Information Processing in the Nervous System," *Science,* Vol. 150 (October 22, 1965) pp. 457-462.

"Computerized Research in the Humanities; A Survey," *ACLS Newsletter,* Vol. 16 (May 1965) pp. 7-37.

Davy, Charles. *Words in the Mind; Exploring Some Effects of Poetry, English and French.* Harvard University Press, 1965.

Fink, Donald G. *Computers and the Human Mind.* Anchor Book, 1965.

Fogel, L. *Biotechnology; Concepts and Applications.* Prentice-Hall, 1963.

Galton, Lawrence. "Science Stands at Awesome Thresholds," *New York Times, Magazine,* December 2, 1962.

George, Frank H. *Cybernetics and Biology.* W. H. Freeman, 1965.

Hocking, Brian. *Biology - Or Oblivion; Lessons from the Ultimate Science.* Schenkman, 1965. bibl.

Kepes, Gyorgy, editor. *Structure in Art and in Science.* Braziller, 1965. bibl.

Life, Incorporated. "Control of Life; A Four-part Series on the Frontier Achievements of Medical Science and Their Implications for Individuals and Society," *Life Magazine,* September 10, . . . October 1, 1965.

Loomba, R. P. *Selected Bibliography on Technical Obsolescence.* Technical Note SED-TN-118, Stanford Research Institute, May 1966.

Lynton, Norbert. *The Modern World.* McGraw-Hill, 1965. bibl. (Landmarks of the World's Art.)

McCann, G. D. "Nervous System Research With Computers," *Science,* Vol. 148 (June 18, 1965) pp. 1565-1577.

McHale, John. "An International Scientific City," *Architectural Design,* October 1965.

Masturzo, A. *Cybernetic Medicine.* Thomas Publishers, 1965.

Questler, Henry, editor. *Essays on the Use of Information Theory in Biology.* University of Illinois Press, 1953.

Schrieber, Flora Rheta. The Computer Age in Psycholanalysis. Science Digest, Vol. 57 (January 1965).

Science Year; The World Book Science Annual, 1966. Field Enterprises Educational Corporation, 1966.

Speiregen, Paul D. Urban Design; The Architecture of Towns and Cities. McGraw-Hill, 1965. bibl.

Sterling, T. O., and S. L. Pollack. Computers and the Life Sciences. Columbia University Press, 1966.

Teddington, England. National Physical Laboratories. Mechanization of Thought Process. H. M. Stationery Office, 1959-1961.

Tomkins, Calvin. The Bride and the Bachelors; The Heretical Courtship in Modern Art. Viking, 1965.

Weisskopf, Victor, F. Knowledge and Wonder; The Natural World as Man Knows It. Revised edition. Doubleday, 1966.

Wiener, Norbert. Cybernetics of the Nervous System. American Elsevier, 1965.

______________. Progress in Bio-Cybernetics. Volume 2. American Elsevier, 1965.

Woolridge, Dean E. The Machinery of Life. McGraw-Hill, 1966.

CYBERNATION AND UNDERDEVELOPED AREAS

Aron, Raymond, editor. World Technology and Human Destiny. Translated by Richard Seamer. University of Michigan Press, 1963.

An edited record of papers and discussions at the Basle-Rheinfelden Conference in 1959, with among others, Aron, George Kennon, Robert Oppenheimer, Richael Polanyi, Eugene Rostow, J. L. Talmon. Brilliant talk about world politics and ideology.

Spicer, Edward H., editor. Human Problems in Technological Change; A Casebook. Wiley, 1952. bibl.

This Russell Sage Foundation sponsored book gives 15 cases of successful and unsuccessful introduction of new ideas and methods in agriculture, industry, and medicine to areas deficient in these technologies. Useful to students concerned with introducing change, and to those persons involved in any Technical Assistance programs.

General reference sources particularly useful for further information are:

Business Periodicals Index, 1958-date. Monthly.

Public Affairs Information Service. Bulletin, 1915-date. Weekly.

Reader's Guide to Periodical Literature, 1900-date. Semi-monthly (July, August monthly.)

Social Sciences and Humanities Index, 1907-date. Quarterly.

United Nations. Statistical Yearbook, 1948-date. Annual.

Other significant readings:

Bowman, Mary Jean, and W. Warren Haynes. "East Kentucky's Most Valuable Underdeveloped Resource: People," Annual Report of Resources for the Future, Incorporated, 1963.

__________, __________. Resources and People in Eastern Kentucky. Johns Hopkins University Press, 1963.

Ferman, Louis A., et al, editors. *Poverty in America; A Book of Readings.* Michigan University Press, 1965. bibl.

Ford, Thomas F., editor. *Southern Appalachian Studies; Berea, Kentucky.* University of Kentucky Press, 1962. bibl.

International Conference on Population, Johns Hopkins School of Hygiene and Public Health, May 1964. *Proceedings, Population Dynamics, International Action and Training Programs.* Edited by Minoru Muramatsu and Paul A. Harper. Johns Hopkins, 1965.

Kelso, Louis O., and Patricia Hetter. "Uprooting World Poverty; A Job for Business," *Business Horizons*, Fall 1964, pp. 37-46.

Lekachman, Robert. "The Automation Report," *Poverty and Human Resources Abstracts,* Vol. 1, No. 4 (1966) pp. 25-32.

Munn, Robert F. *The Southern Appalachians; A Bibliography and Guide to Studies.* West Virginia University Library, 1961.

Pearsall, Marion. *Little Smoky Ridge; The Natural History of a Southern Appalachian Neighborhood.* University of Alabama Press, 1959. bibl.

Pi-Sunyer, O., and T. DeGregor. "Cultural Resistance to Technological Change," *Technology and Culture,* Vol. 5 (Spring 1964) pp. 247-253.

Poverty and Human Resources Abstracts, 1966-date. Bimonthly. The Institute of Labor and Industrial Relations, Ann Arbor, Michigan, 1965-date.

Reed, Stanley Foster. "Entrepreneurship and the Depressed Area," *The Yale Review*, 1964.

ReQua, Eloise G., and Jane Statham. *The Development Nations; A Guide to Information Sources Concerning Their Economic, Political, Technical and Social Problems*. Gale Research Institute, 1965.

Theobald, Robert. *The Rich and the Poor*. Mentor Books, 1960.

U. S. Department of Agriculture, Economic Research Service. *Agricultural Economic Report No. 73; Employment, Unemployment and Low Incomes in Appalachia.* U. S. Govt. Print. Off., 1965.

U. S. Statutes at Large, Vol. 79. Appalachian Region Development Act, March 9, 1965. Public Law 89-4, Title I, pp. 5-73.

Ward, Barbara. The Rich Nations and the Poor Nations. Hamish Hamilton, 1962.

Weller, Jack E. Yesterday's People; Life in Contemporary Appalachia. University of Kentucky, 1965.

Zimmerman, L. J. Poor Lands, Rich Lands; The Widening Gap. Random House, 1965.

CYBERNATION AND EDUCATION

Ashby, Sir Eric. *Technology and the Academics.* St. Martin's Press, 1964.

Essay on Universities and the Scientific Revolution, by the noted designer of education systems in Africa.

Brickman, W. W., and S. Lehrer. *Automation, Education and Human Values.* School and Society Books, 1965. bibl.

In cooperation with IBM Corporation, the "Humanities Project on Technological Change and Human Values"; seminars with business, civic and other professional leaders, and technologists and humanists participating.

General reference sources particularly useful for further information are:

Education Index, 1929-date. Monthly (except June, August.)

Library Literature, 1921-1932, 1933-date. Monthly.

New York Times Index, 1913-date. Semi-monthly.

Public Affairs Information Service. Bulletin, 1915-date. Weekly.

Reader's Guide to Periodical Literature, 1900-date. Semi-monthly (July, August monthly.)

Social Sciences and Humanities Index, 1907-date. Quarterly.

Other significant readings:

Ashby, Sir Eric. "Education as an Investment in Man," *Overseas,* Vol. 3 (March 1964) pp. 8-14.

________________. "Technological Humanism," *Journal of the Institute of Metals,* Vol. 85 (1957) pp. 461-467.

Baskin, Samuel, editor. *Higher Education; Some Newer Developments.* McGraw-Hill, 1965.

Bremeld, Theodore, and Stanley Elam. "Values in American Education; An Interdisciplinary Approach," *Phi Delta Kappa,* Bloomington, Indiana, 1964.

Brown, James W., and James Thornton, editors. New Media in Higher Education, National Education Association, 1963.

Center for the Study of Liberal Education for Adults. "Perspective on Automation; Three Talks to Educators," Notes and Essays, No. 43, Boston University, 1964.

Coulson, J. E. Programmed Learning and Computer-Based Instruction. Wiley, 1962.

Curle, Adam, et al. ·Some Educational Implications of Technological Development. Cambridge, 1965. bibl.

Davenal, G. "Career Planning for Age of Automation," Parents Magazine, (September 1964) pp. 74-76.

DeGrazia, Alfred, and David A. John, editors. Revolution in Teaching; New Theory in Technology and Curricula. Bantam Books, 1964.

DeVane, William Clyde. Higher Education in Twentieth-Century America. Harvard University Press, 1965.

Evans, Luther H., and George E. Arnstein, editors. "Automation and the Challenge to Education," National Education Association Project on the Educational Implications of Automation, 1962.

Friedman, Albert B., editor. Creativity in Graduate Education, Addresses by Milton S. Eisenhower, Louis T. Benset, Robert R. Sears. Commentary by W. T. Jones, Albert N. Friedman, and Stanley Foster Reed. Claremont, California, 1964.

Fuller, R. Buckminster. Education Automation. Southern Illinois University Press, 1962.

Goldberg, Maxwell H. "General Education and the Explosion of Knowledge," General Education; Current Ideas and Concerns. Association for Higher Education, 1964.

______________. "Meaning and Metaphor; On Teaching Values Through Poetry at a Steelworkers Institute," Center for the Study of Liberal Education for Adults. Boston University, 1965.

Grossman, Alvin, and Robert L. Howe. Data Processing for Educators. Educational Methods, Aldines, 1965.

Humanities Center for Liberal Education in an Industrial Society, Incorporated. "Human Competence in the World of Change; Business and the Humanities," The Michigan Quarterly Review, Vol. 4 (Spring 1965).

Hurwitz, H. L. "What Shall We Teach Our Children About Automation?" Social Education, Vol. 27 (October 1963) pp. 310-304.

Hutchins, R. M. "Are We Educating Our Children for the Wrong Future?" Saturday Review, (September 11, 1965) pp. 66-67.

Lewis, Arthur O., Jr. The Society of Men and Machine. CCLE Humanities Study-Discussion Course, Center for Continuing Liberal Education, University Park, Pennsylvania, 1965.

Lumsdaine, Arthur, and R. Glaser. Teaching Machines and Programmed Learning. National Education Association, Division of Audio-Visual Instruction, 1960.

Lysaught, Jerome. A Guide to Programmed Instruction. Wiley, 1963.

National Education Association. Project on the Educational Implications of Automation. Articles by George E. Arnstein, Luther Evans, and Virgil Rogers. National Education Association, Clearinghouse for Bibliographical and Other Resources, Washington, D. C., 1963.

Oliva, Peter F., and Ralph A. Scrafford. Teaching in a Modern Secondary School. Merrill, 1965. bibl.

Oliver, Robert. "Education in the Year 2000 A.D.," Vital Speeches of the Day, Vol. 30, No. 13 (April 15, 1964).

Rickover, Hyman G. "A Humanistic Technology," The American Behavioral Scientist, Vol. 14 (1965).

Roucek, Joseph S., editor. Programmed Teaching; A Symposium on Automation in Education. Philosophical Library, 1965. bibl.

Silberman, Charles E. "Technology is Knocking at the Schoolhouse Door," Fortune, Vol. 74, No. 3 (August 1966) p. 120.

Smallwood, Richard D. A Decision Structure for Teaching Machines. The M.I.T. Press, 1962.

Suppes, Patrick. "Plug-in Instruction," Saturday Review, (July 23, 1966) pp. 28-30.

Swets, John A., and Wallace Feurzeig. "Computer-Aided Instruction," Science, Vol. 150 (October 29, 1965) pp. 572-576.

Theobald, Robert. "Higher Education and Cybernation," National Education Association Journal, (March 1966) pp. 26-29.

Thompson, Ian M. "A Student's View; Man and the Machine; For Whom the School Bell Tolls," Reports on Higher Education, Western Interstate Commission for Higher Education, 1966.

Watson, Goodwin, editor. "No Room at the Bottom; Automation and the Reluctant Learner," Automation Project. National Education Association, 1963.

Wolfbein, Seymour L. "Automation, Education, and Individual Liberty," Teachers College Record, Vol. 66 (October 1964).

Wright, Betty Atwell. Educating for Diversity. John Day, 1965. bibl.

TECHNOLOGY AND SOCIETY IN THE FUTURE

Demczynski, S. Automation and the Future of Man. George Allen and Unwin, 1964.

A sociological, philosophical and psychological look at industrial society, with particular reference to ideologies. The basic properties of life, brain, and mind, man's position in the universe, and the purpose of his existence, are all examined in the light of the ultimate potential of the machine.

Fuller, R. Buckminster. "Prospect for Humanity," Saturday Review, Vol. 47 (August 29, 1964).

Notes on the Future Series. Topics considered are trends in medical science, political alternatives, a broad definition of automation, the cooperating generalist vs. the isolated specialist, and so forth.

Greenberger, Martin, editor. Computers and the World of the Future. The M.I.T. Press, 1962. bibl.

A symposium in which leading authorities, including Norbert Wiener and C. P. Snow, contribute their views on the impact of the computer on management, libraries, education, national policy, and the survival of mankind.

General reference sources particularly useful for further information are:

Business Periodicals Index, 1958-date. Monthly.

PMLA (Modern Language Association of America. Publication.), 1919-date. Monthly. See, especially, annual May issue, International Bibliography.

Reader's Guide to Periodical Literature, 1900-date. Semi-monthly (July, August monthly.)

United Nations Library. Documents Index Unit, 1950-date. Monthly.

U. S. Government Publications Monthly Catalog, 1895-date. Monthly.

Vital Speeches of the Day, 1934-date. Monthly.

Other significant readings:

Asimov, Isaac. *I, Robot*. Doubleday, 1950.

______________. "Life in 1990," *Science Digest*, (August 1965).

Baade, Fritz. *The Race to the Year 2000; A Paradise or the Suicide of Mankind.* Doubleday, 1962.

Bellamy, Edward. *Looking Backward*. Edited by Fred White. Hendricks, 1946. (Originally, c1880)

Brown, Harrison. *The Challenge of Man's Future*. Viking Press, 1956.

______________, James Bonner, and John Weir. *The Next Hundred Years; Man's Natural and Technological Resources*. Viking Press, 1957.

Clarke, Arthur C. *Profiles of the Future; An Enquiry Into the Limits of the Possible.* Harper and Row, 1963.

Clarke, I. F. *The Tale of the Future From the Beginning to the Present Day; A Checklist of Those Satires, Ideal States, Imaginary Wars and Invasions, Political Warnings and Forecasts, Interplanatary Voyages and Scientific Romances - All Located in an Imaginary Future Period - That Have Been Published in the United Kingdom Between 1644 and 1960.* The Library Association (London), 1961.

Ernst, Morris Leopold. *Utopia 1976.* Rinehart, 1955.

Fuller, R. Buckminster. "Notes on the Future. Series. *Saturday Review*, Vol. 47 (October 3, 1964).

______________. "The Prospect for Mankind," *Saturday Review*, Vol. 47 (September 19, 1964).

Gabor, Dennis. *Inventing the Future.* Secker and Warbury, 1963.

Gordon, Theodore J. *Ideas in Conflict; A Re-evaluation of Several Theories Discredited by our Scientific Establishment*. St. Martin's Press, 1966.

Halacy, D. S., Jr. *Cyborg - Evolution of the Superman*. Harper and Row, 1965.

Huxley, Aldous. Brave New World. Harper, 1932.

______________. Brave New World Revisited. Harper, 1958.

Landsberg, Hans H., Leonard L. Fishman, and Joseph L. Fisher. Resources of the Future; Patterns of Requirements and Availability 1960-2000. Johns Hopkins Press, 1963.

Lederberg, Joshua. "Experimental Genetics and Human Evolution," Bulletin of the Atomic Scientist, Vol. 22 (October 1966) pp. 4-11.

More, Sir Thomas. Utopia. Oxford Press, 1904. (Yale University Press, 1964.)

Orwell, George. 1984. Signet, 1949.

Parrington, Vernon Louis, Jr. American Dreams; A Study of American Utopias. Russell and Russell, Inc., 1964.

Piel, Gerard. "Abundance and the Future Man," Atlantic Monthly, Vol. 213 (April 1964).

Poluk, Frederik. The Image of the Future; Enlightening the Past, Orienting the Future, and Forecasting the Future. Oceana Publications, 1961.

Sarnoff, David. "By the End of the Twentieth Century," Fortune, Vol. 49 (May 1964).

Wolstenholme, Gordon, editor. Man and His Future. Little, Brown, and Company, 1963.

APPENDIXES

APPENDIX I

COURSE SYLLABUS

DIVISION OF ENGINEERING
SAN JOSE STATE COLLEGE

Engr 100
3 Units

CYBERNATION AND MAN

Fall 1966
Parkman-Coordinator
Room E132

(Lectures on T. Th at 1:30 and Activity/Discussions on Th from 2:30-5:20)

Objective	To provide concerned individuals opportunity to investigate, discuss, debate and evaluate all aspects of the anticipated impact of cybernation (computer controlled automatic production systems) on the political, economic, social and moral structure of mankind.
Prerequisite	Upper division standing. A preregistration procedure will be generally used to assure a distribution of students from various disciplines.
Texts and Reference Materials	Refer to schedule for complete list of texts to be purchased by students, reference materials on reserve in the Library, and materials to be distributed in class.
Lectures	The instructional staff will be from the diverse disciplines having a concern for cybernation and will come from both San Jose State College and elsewhere. These instructors from engineering, the social sciences, business, and the humanities and arts will present facts and opinions in a spirit of free inquiry with the intent that all of the alternatives pertaining to cybernation are open to examination, and an assurance that each alternative is to be given fair hearing.
Computer Instruction	By means of instruction on teaching machines and lectures, students will be expected to develop a capability of programming simple problems on the IBM 1620 digital computer and an appreciation for its capabilities. Approximately four of the semester's fifteen activity periods will be devoted to computer instruction.
Field Trips	Students will be expected to go on at least two organized field trips during regularly scheduled activity periods. In addition, students will be provided opportunity to visit on their own time one of a number Bay Area installations having computer and/or automated production processes.
Assignments	Students will submit four reports of 150 to 2000 word length on their research, observations, and opinions. These will be graded on the basis of the quality of content, indications of creative thought, organization, and grammar. Reports will in general provide the basis for discussion during the activity periods.
Examinations	A mid-term and final examination will be given.

Attendance	Attendance records will be maintained. Course grades of students having records of poor attendance may be lowered.
Basis of Final Grade	Midterm Examinations Final Examination Reports Discussion

DIVISION OF ENGINEERING
SAN JOSE STATE COLLEGE

ENGR 100--CYBERNATION AND MAN Fall 1966

INSTRUCTIONAL STAFF--FALL SEMESTER

San Jose State College--Division of Engineering

Course Coordinator: Ralph Parkman, Professor of Materials Science

Assistant Course Coordinator: Ronald Swenson, Instructor of Engineering Graphics

Norman O. Gunderson, Dean of Engineering

S. P. R. Charter, Visiting Lecturer in Engineering (part time)

Edward A. Dionne, Associate Professor of Engineering Graphics

Ralph Popkin, Supervising Equipment Technician

Visiting Lecturers (The following guests are scheduled to appear during the fall semester. Substitutions on the list may be made due to circumstances beyond our control, and other guests may be added at a later date.)

Mr. Wade Cole - IBM Corporation

Dr. Louis Fein - Computer Consultant, Palo Alto

Dr. Ole Holsti - Department of Political Science, Stanford University

Mr. David Miller - Pacific Research Center, Palo Alto

Dr. Stan Plog - President, Behavior Science Corporation

Prof. Fred Spratt - Art Department, San Jose State

Rev. Roy Hoch - San Jose State

Mr. Jack Vogel - UTC Corporation

Mr. P. Wildhofer - Labor Analyst, California Dept. of Employment

DIVISION OF ENGINEERING
San Jose State College

Engr. 100 - CYBERNATION AND MAN

FALL SCHEDULE - 1966

Date		Subject Matter	Discussion Leader	Reference Reading	Assignment and Due Date
9/20		Orientation	Parkman		Paper #1: Write 750-1000 word paper on "Influences of Freeway Technology on Society" Due 10/11
9/22	L A	Introductory Lecture and Discussion	Charter	BK, E CD 2,8	
9/27	L	History of Man-Machine Systems (I)	Parkman	BK A, Ch.9 BK F, Ch. 10,13	
9/29	L	Computer Instruction	Dionne	LR 8,9,10	
	A	Computer Activity I	Dionne		
10/4	L	History of Man-Machine Systems (II)	Parkman	" LR 7,20	
10/6	L	Systems Today and Tomorrow	Swenson	LR 21,22, 23, 14	
	A	Field Trip #1 Traffic Study	Popkin		
10/11	L	Cybernetics and Communication I	Parkman	BK A, Ch. 1,2 BK B, Ch.1,2 LR 11,13,15, 16,20	Paper #1: Due today
10/13	L	Cybernetics and Communication II	Parkman	BK A, Ch. 3,4	
	A	Computer Activity II	Dionne		
10/18	L	Cybernetics and Communication III	Parkman	BK A, Ch. 5,6 BK B, Ch. 3,4 LR 14,17, 18,19,20	Paper #2: In 1000 words or more describe your idea of the probable nature of a cybernated world 30 years hence; and compare with predictions of Bellamy's Looking Backward, Orwell's 1984, Huxley's Brave New World or a utopia or dystopia of your own devising. Due 11/22
10/20	L	Introduction to Assignment 2	Charter	BK C, Ch. 3,4 LR 4, 6,7 CD 2, 5,6	
	A	Class discussion of Paper #1	Charter Parkman Swenson Dionne		
10/25	L	Basic Factors #1: Industry and Labor	Parkman	BK C, Pts. 1,3,4 LR 1,2,6,7, 26 CD 2,9, 10,11,12	
10/27	L	Concerns of Labor	Wildhofer		
	A	Computer Activity III	Dionne		

Date		Subject Matter	Discussion Leader	Reference Reading	Assignment and Due Date
11/1	L	Concerns of the Industrial Manager	J. Vogel UTC	BK C, Pts. 1,3,4 LR 1,2,6,7, 26 CD 2, 9,10,11,12	
11/3	L	Discussion: Cybernation and Unemployment	Staff		
	A	Field Trip #2 Bakery	Popkin		
11/8	L	Midterm Exam	Staff		
11/10	L	Computer Activity #4	Dionne		
	A	Films and wind-up discussion	Dionne		
11/15	L	Basic Factors #2: Cybernation and Economics	Lee	BK D LR 7(Ch. 3,4) LR 27,28,29	
11/17	L	Concerns in Economics P.I. Bill of Rights	L. Fein	CD 12,13 15,7	
	A	Discussion	L. Fein		
11/22	L	Laying Foundation for Case Study	Swenson	BK D LR 38-42 CD 20,21, 22	Paper #2 Due Today Paper #3: Write a paper of 1000 words or more on the problem of cybernation as related to a specific depressed or developing area. Due 1/3/67
11/24		Thanksgiving Holiday			
11/29	L	A Look at an Underdeveloped Area	Hoch	"	
12/1	L	Concerns of the Human Ecologist for the Future	Charter		
	A	Discussion of Paper #2	Charter Parkman Dionne Swenson		
12/6	L	Basic Factors #3 Cybernation and Artificial Intelligence	Cole	BK C, Pt. 2, Ch.7 BK B, Ch.8, 9,10 LR 12, Ch.9	

Date		Subject Matter	Discussion Leader	Reference Reading	Assignment and Due Date
12/8	L	Concerns of the Behavioral Scientist in Politics and Government	S. Plog Basico	BK C, Pt. 5,6 LR 33,34	
	A	Discussion	"		
12/13	L	Concerns of the Behavioral Scientist in International Relation	O. Holsti	"	
12/15	L	Concerns of the Humanist	D. Miller	BK A LR 7,30,7 CD 4,8	Paper #4: Due 1/10/66 Write a positive statement of about 150 words on cybernation which you will be willing to defend. The best and most provocative statements will be duplicated and discussed at the last class meeting.
	A	Discussion			
		Christmas Recess			
1/3	L	Basic Factors #4 What to do: The problem of leisure	Parkman	BK C, Pt.8 LR 25,26 CD 19	Paper #3 due today
1/5	L	The Concern of the Artist	G. Walters (video)	"	
	A	Discussion	F. Spratt		
1/10		Basic Factors #5 Cybernation and Education Concern of the Educator		BK C, Pt.7 CD 30,31, 32 LR 16, 17,18,19	Paper #4 due today
1/12	L	Evaluation of Paper #3	Swenson & Staff		
	A	General discussion of Cybernation			
1/17		Course Evaluation Discussions of Paper #4 continued to final	Staff		
		Final exam to consist of 3 essay questions and rest of time to oral discussion of #4 papers.	Staff		

DIVISION OF ENGINEERING
SAN JOSE STATE COLLEGE

Fall 1966

ENGR 100 - CYBERNATION AND MAN

COURSE READING LIST

BOOKS PURCHASED BY STUDENTS:

Required

A.	Human Use of Human Beings: Cybernetics and Society N. Wiener, Doubleday-Anchor Books	$ .95
B.	Intelligent Machines: An Introduction to Cybernetics D. A. Bell, Blaisdell Publishing Co./Random House	1.45
C.	Automation: Implications for the Future Ed. by M. Philipson, Vintage	1.95
D.	The Challenge of Abundance R. Theobald, Mentor	.60

Recommended

E.	Man on Earth, S.P.R. Charter, Contact	5.00
F.	Technics and Civilization, Lewis Mumford, Harbinger	2.95
G.	Looking Backward, E. Bellamy	.60

LIBRARY RESERVE LIST (LR):

Cybernation and Society - General

1. Weeks, R. P. (ed.) Machines and the Man. Appleton-Century.
2. Brady, R. Organization, Automation and Society. Univ. of California Press, 1961.
3. George, F. Automation Cybernetics and Society. Philosophical Library, 1959.
4. Ellul, J. The Technological Society. Knopf, 1964.
5. Walker, Charles R. Modern Technology and Civilization. McGraw-Hill, 1962.
6. Diebold, J. Beyond Automation. McGraw-Hill, 1964.
7. Hilton, Alice Mary. The Evolving Society. Institute for Cybercultural Research, 1966.

History of Technology

8. Soulard, R. History of the Machine. Hawthorn Books, 1963.
9. Klemm, F. History of Western Technology. Scribner, 1959.
10. Singer. History of Technology. Oxford, Clarendon Press (Reference), 1954.

Computers, Cybernetics, and Communication

11. Latil, P. *Thinking by Machine, A Study of Cybernetics*. Houghton-Mifflin, 1957.
12. Wiener, N. *Cybernetics*. MIT Press, 1961.
13. Pask, G. *An Approach to Cybernetics*. Harper, 1961.
14. Beer, S. *Cybernetics and Management*. Wiley, 1959.
15. Guilbaud, G. T. *What is Cybernetics*. Criterion, 1959.
16. Scientific American, *Automatic Control*. Simon & Schuster, 1955.
17. Pierce, J. R. *Symbols, Signals and Noise*. Harper, 1961.
18. Taube, Mortimer. *Computers and Common Sense*. Columbia University Press, 1961.
19. McLuhan, Marshall. *Understanding Media*. McGraw-Hill, 1964.
20. Hilton, Mary Alice. *Logic, Computing Machines and Automation*. Sparta Books, 1963.

General Systems and Systems Theory

21. *General Systems*. Yearbook of the Society for General Systems Research. Vol. I, 1956.
22. Kuhn, A. *A Study of Society*. R. D. Irwin, 1963.
23. Boguslaw, Robert. *The New Utopians*. Prentice-Hall, 1965.
24. Smith, O. J. *Feedback Control Systems*. McGraw-Hill, 1958.

Cybernation, Employment, and Leisure

25. Pieper, J. *Leisure--The Basis of Culture*.
26. Friedmann, G. *The Industrial Society*. Free Press, Glencoe, Ill., 1955.

Cybernation and Economics

27. Kelso, L. and Adler, M. *The Capitalist Manifesto*. Random House, 1958.
28. Kelso, L. and Adler, M. *The New Capitalists*. Random House, 1961.
29. Galbraith, J. K. *The Affluent Society*. Houghton-Mifflin, 1958.

Cybernation and Education

30. Brickman, W. W. and Lehrer, S. *Automation, Education and Human Values*. School and Society Books, 1966.
31. Fuller, R. Buckminster. *Education Automation*. Southern Illinois Univ. Press, 1962.
32. Lumsdaine, Arthur and Glazer, R. (ed.) *Teaching Machines and Programmed Learning*. NEA, 1960.

Cybernation, Politics, and the Social Sciences

33. Borko, H.(ed.) *Computer Applications in the Behavioral Sciences*. Prentice-Hall, 1962.
34. Pool, I.deS., Abelson, R. P. and Popkin, S. L. *Candidates, Issues, and Strategies*. MIT Press, 1964.

Cybernation, The Scientific Professions and the Arts

35. George, F. H. Cybernetics and Biology. W. H. Freeman, 1965.
36. Himsworth, H. and Godber, G. (ed.) Mathematics and Computer Science in Biology and Medicine. 1965.
37. Mumford, Lewis. Arts and Technics. Columbia Univ. Press, 1952.

Cybernation and Underdeveloped Areas

38. Spicer, Edward H. (ed.) Human Problems in Technological Change. J. Wiley (Russell Sage Foundation), 1952.
39. Bowman, Mary and Haynes, W. Resources and People in Eastern Kentucky. Johns Hopkins Univ. Press, 1963.
40. Theobald, R. The Rich and the Poor. C. N. Potter, 1960.
41. Appalachian Region Development Acts of 1964-65.
42. USDA Agricultural Economic Report #73: Employment, Unemployment, and Low Incomes in Appalachia.

CLASS DISTRIBUTION (CD)

Cybernation and Society - General

1. Michael, Donald. "Cybernation and Social Change."
2. Silberman, Charles E. "Is Technology Taking Over?"
3. Theobald, Robert. The Great Non-Debate on "Automation and Cybernation."
4. Kranzberg, M. "Technology and Human Values."
5. Diebold, J. "The New World Coming."
6. Kean, D. "Cybernetics and the Mad Hatters."
7. "The Triple Revolution."
8. "Man, Machines, and Morality." S.P.R. Charter.

Cybernation, Unemployment, and Leisure

9. Ells, R. W. "Automation and Unemployment."
10. Ferry, W. H. "Technology and Jobs."
11. Silberman, C. "Technology and the Labor Market--The Real News."
12. Fein, L. "The Automation Commission Report."

Cybernation and Economics

13. Kelso, L. "The Full Production Act of 1965."
14. Kelso, L. "The Full Production Act of 1965"--Explanatory Note
15. Kelso, L. and Hetter, P. "Poverty and Profits."

Cybernation and Education

16. Thompson, I. M. "Man and Machine: For Whom the School Bell Tolls."
17. Suppes, P. "Plug-In Instruction."
18. Silberman, C. E. "Technology is Knocking at the Schoolhouse Door."
19. Fein, L. "Intellectual Preparation for Living in a Rapidly Automating Society."

Cybernation and Underdeveloped Areas

20. Bowman and Haynes. "East Kentucky's Most Valuable Underdeveloped Resource--People."
21. Reeb, S. F. "Entrepreneurship and the Depressed Area."
22. Kelso and Hetter. "Uprooting World Poverty."

APPENDIX II

CYBERNATION AND MAN

GUEST LECTURERS

Rev. Conrad Bonifazi, Pacific School of Religion
Mr. Ely Brandes, Stanford Research Institute
Mr. Benny Bufano, San Francisco
President Robert D. Clark, San Jose State College
Mr. Wade Cole, IBM Corporation
Dr. Louis Fein, Palo Alto
Mr. W. H. Ferry, Center for the Study of Democratic Institutions.
Prof. R. Buckminster Fuller, Southern Illinois University
Dr. George C. Halverson, San Jose State College
Dr. Alice Mary Hilton, President, Institute for Cybercultural Research
Rev. Roy Hoch, Campus Pastor, San Jose State College
Dr. Harold M. Hodges, San Jose State College
Dr. Ole Holsti, Stanford University
Dr. David Kean, IBM Corporation
Dr. Louis Kelso, Kelso, Cotton & Ernst, San Francisco
Prof. Kenneth Kim, San Jose State College
Dr. Marvin E. Lee, San Jose State College
Dr. Daniel Lopez, San Jose State College
Mr. David Miller, Management and Economics Research, Inc., Palo Alto
Mr. Bruse Moncrieff, IBM Corporation
Dr. Donald Newnan, San Jose State College
Dean Robert Parden, Santa Clara University
Mr. Michael Peevey, California Labor Federation, AFL-CIO
Dr. Stanley Plog, President, Behavior Science Corporation, Van Nuys
Dr. William H. Poytress, San Jose State College
Rev. W. Rasmussen, Pacific School of Religion
Mr. Walter Schondorf, Safeway Stores
Prof. Donald Simm, San Jose State College
Mr. Kent Smith, Stanford University
Prof. Fred Spratt, San Jose State College
Dr. Peter Szego, Ampex Corporation
Dr. Thomas Tutko, San Jose State College
Mr. Jack Vogel, United Technology Corporation
Dr. Gibson Walters, San Jose State College
Prof. S. Brooks Walton, San Jose State College
Mr. Paul Wildhofer, California Department of Employment

APPENDIX III

EXAMPLES OF STUDENT PAPERS

W. G. de Vriend
Engineering 100
October 11

INTRODUCTION--CURSE OR BLESSING?

"Cybernation--a curse or a blessing?" When I first heard this question posed, I mainly thought that it was a bit early in this course to expect a good answer. For only a few weeks I had been listening to the engineers who seemed to have left their traditionally limited sector in society to go out into the world and tell about the miracles that their art was preparing; this profession which to most people, I am sure, had seemed equally limited to its own area up till now. When I was in school, engineering occupied a position comparable to gymnastics--you didn't do much about it yourself, and you would leave the people alone who did. Such was the good tradition of the Humanities that I was brought up in. But now, suddenly, there was Cybernetics--very surprising. And along with an appreciation for the way in which the engineers try to translate their art came a realization of how little I know. Of course, that may get especially bad if you read a book like Norbert Wiener's, though.

But on closer view, the question "a curse or a blessing?" regarding something which seems to store such profound and drastic effects on the structure of society depends, I think, ultimately upon any individual's personal outlook on life and man's future. For anybody who is convinced that Cybernation as it is predicted will come to exist, Cybernation will be almost synonymous with Future--and so his own perception of Future in general will color his views on Cybernation. At least to me, it does not seem feasible to maintain that Cybernation will be a curse while at the same time denying that it will develop to the extent as currently foreseen. That means that if somebody is prepared to assume as true the predictions about the effect of Cybernation on the employment situation, he has to take into consideration also some of the views concerning the effect of this on structures and attitudes in society as a whole, such as are for example advocated in the Triple Revolution document.

Now my own personal way of standing in the present and looking toward the future is one of moderate optimism. That is, I believe the human race is in a very critical stage, which is rapidly getting more critical. But I think that it is capable of getting through it in a way which will ultimately prove to be beneficial. Why I do not, unlike a lot of people, voice a belief in extinction, bloodshed, ultimate destruction and what else have you, does not so much mean that I have solid facts to support my view. It is largely just because I don't like people who make views like those public. They often do it with a very irritating frequency and emphasis which only make it clear to me that what is at stake is their own conceit and sophistication. They are the people who on Last Judgment Day or its non-clerical version want to stand among the crowd and tell them, they have known all along. Taking things for granted in this fashion seems to me very irresponsible. So, yes, I think Cybernation, depending on how efficiently introduced into the structure of society will be sooner or later a blessing.

MY OWN ROLE IN A "CYBERNATED" SOCIETY

A further consideration of how I imagine my own role in the society of the future requires a further summing-up of developments that are occurring presently. To return to the Triple Revolution document, in it is mentioned the Cybernation Revolution. Along with that, one could mention the amazing progress of the application of Nuclear Energy which is now opening wide perspectives for obtaining fresh water out of the sea economically. The Weaponry Revolution has made war implausible. The Human Rights Revolution that the authors talk about is accompanied by and a result of other developments. Whatever may be considered at fault with the character changes that are taking place in the US (David Riesman's Other Directedness) it certainly enhances optimism for greater flexibility among the citizens who will have to participate in the great developments to come, whether they will or not. It is no accident that both the Peace Corps and the Civil Rights Movement are of this era. For some time already, we have been moving toward the Welfare State and greater equality for all. Measures like those proposed in the Triple Revolution are, therefore, not brand new. We have been developing toward them. What the final outlook of society would be after they have been effected and incorporated I could not tell; but I have a strong suspicion that much of the present commercial set-up of American society will vanish in the end. This seems logical with an accelerating trend towards socialism and less emphasis on money through the material achievements of technology. Of course, this may seem a long way ahead, but I am planning to stay on this earth for some fifty more years, and things promise to be very different within that time-span. My own work at present is commercial--I am in advertising--and during the last two years I have promoted one washing powder against another washing powder. Well, even now there are already masses of people deeply convinced that such activities are very superfluous. I am liberal, and I think they may be quite right. As a consequence, I should consider what I should do once there would be no more washing powder, or liquor, or even frozen canned orange concentrate to promote. The answer to that is rather simple: I am convinced that there will be a very great need for information of all kinds, to lubricate the introduction of a new society and new concepts. I am not so scared of becoming "useless," or "jobless" for that matter.*

MY MAIN CONCERN

The society pictured by the prophets of the Cybernation movement is one that is just frighteningly different from the one we have now, if you stand still for a moment and think about it. It is not only in form, in material achievements; we have been getting used to Jules Verne's promising us marvels, and we have seen them come to reality. The upsetting thing is rather that people are apparently going to be very different, and with them, what makes people--ideas and an outlook on life.

---

*One might feel that this answer needs further clarification, or at least some more details. In a society on its way towards Cybernation, I imagine there will be a considerable need for information for its citizens concerning the changes that are occurring and the broad background of the total development. This information would have to be channeled in a conscious effort where skills formerly employed in advertising could be utilized. I think, for example, of TV "commercials" or programs designed for this purpose. The way in which the instruments of Cybernation themselves would be utilized in this effort could be the use of computers in compiling and combining of survey data on opinions and information penetration level.

But these new human beings and their new society seem so terribly remote from the present situation. The way they are depicted, however vague, sounds attractive--but where is the connection with now, how is the complexity of the development towards them going to be handled? "Retraining" and "Job Corps" hardly seem anything like adequate answers, and the more I ponder about this, the more it seems that now more than ever a strong central government is required, one with a full understanding of its time, unbiased by motivations of popularity or political deals, and very sincerely aware that yesterday's outlook is different today and will be antique tomorrow. . . To me, it does not seem like a man of such sincerity would be likely to go through the incredibly irrational comic opera of the American presidential election campaign. For how is it possible not to be biased by considerations of popularity or politics when all at once, with the appearance of Cybernation, there appears to be such a tremendous gap--no missile gap, or foreign aid gap, but one in knowledge and values between future and present. In this society, there is a huge proletariat that is deprived of knowledge, that lives with the antiquated conceptions of 19th Century capitalism and religious conceptions of way before that. How are we going to make the leap, and who will be in charge?

Linn Badger
Engineering 100
April 19, 1966

PICTURES OF THE FUTURE

THE CYBERNATED WORLD OF 1991

There is a filter method in photography, so named because all shades of gray are removed in the process. The result is a stark black and white picture that is very dramatic though not as representative of reality as a more conventional one in which all the many shades of gray have not been deleted.

Pictures of the future tend to be cast in black and white. This is necessarily true of utopias which are by nature exaggerations, descriptions of imaginary places which are never to be reached. But because they are constructs of human minds they will reflect the personalities, and in turn the mood of the times of their creators.

The eighteenth and nineteenth centuries were essentially optimistic ones, characterized by faith in science and reason and hope that struggle against outmoded social organization and systems of thought would lead to a progressively better world. Edward Bellamy's Looking Backward expresses this optimism. His world of 2000 is a golden age of happiness, prosperity, and peace. All men are brothers. And all hold title to "the good life" simply by virtue of the fact that they are human beings.

This twentieth century has been more pessimistic. Disillusionment with science and skepticism about the superiority of reason are common. Many have lost faith in the beneficence of change and the inevitability of progress. This pessimism has been expressed, in its extreme, in the fictional negative utopias of Aldous Huxley and George Orwell. The theme of Huxley's Brave New World is that truth (science) when rationally applied leads to social disutility. Happiness and comfort are the values in the world of AF 632.[1] Pain and struggle are unknown to the mechanically created and socially conditioned beings who live out their shallow and inhuman lives in this idiotic world. Orwell depicts not happiness and comfort but fear and poverty in his novel, 1984. War and oppression are permanently imposed by a totalitarian regime in order to produce the appropriate economic and spiritual atmosphere among the depressed masses over whom it rules.

Each of the above utopias predicts trends and things with which we are today familiar--push button entertainment, propaganda, decreasing family loyalties, intolerance for deviance, centralization, rationalization. Yet in essence they are false pictures and will be even more inaccurate in a quarter of a century. A description of more realism, it seems, would moderate between Bellamy's extremely static, tranquil, rather insipid society and the depressing ones of AF 632 and 1984. A "brave new world" with wholesale manipulation of genetics and thought will not be realized in 1991, if ever, and the totalitarianism of 1984 can never be permanently maintained. A description of more realism, also, would need to be modified to include today's exotic sciences and technological innovations. Bellamy's world, in spite of new modes of economic distribution, is basically the traditional nineteenth century world. Orwell virtually ignores the scientific revolution that began during World War II and Huxley vastly understates the material differences that are bound to be present six entire centuries hence.

---

[1] After Ford 632, presumably the twenty-sixth century.

The following pages will attempt to sketch the nature of the world in 1991.

The result may be too drab a picture. In 1941 how many of us would have guessed that today we would have Enovid, instant breakfasts, and forty-eight commuter jets daily between Los Angeles and San Francisco?[2]

It may be too bright because it does not include the possibility of mass nuclear destruction.

It may be too dark because it does not suggest a perfect, peaceful world.

It may be inaccurate because it is prediction based on present trends. Often, however, only fiction and exaggeration are adequate when it comes to anticipating new directions. Scheler advises: "Allow us, therefore, room for man and for his movement which is infinite by nature, and do not tie man to a 'model,' to a pattern, whether in natural or in world history."[3]

With the qualification that the picture could be different, the following pages describe the people, ideas, and things of the world of 1991.

THE WORLD OF 1991

Its People

Underlying all philosophical, social, and political thought is a basic attitude toward human nature and the belief or doubt that it can be changed. Human nature is the same in all times and places, but behavior changes as conditions of life change. Individuals in 1991 will be different in Bellamy's sense that environment will change the motives of human action. Changes in genetics, similar to those that Huxley depicts, will be made experimentally. Drugs to increase intelligence, to ease adaptation to physical conditions and to enhance emotional experience will be in general use. Human beings will appear different: they will be stronger, larger, healthier, and therefore more attractive. They will live longer.

---

[2] Round-trip flights, based on information from PSA, United, and Western Airlines.

[3] Scheler, "Man in an Age of Adjustment," in Varieties of Classic Social Theory, p. 393.

The people of 1991 will still experience grief, sorrow, pain, wanting, and death. They will still be expected to produce,[3] to wait, to make decisions. The entire atmosphere, however, will be less permissive than today, partly because of the overall increase in knowledge and information, partly because the problems and complexities of a world that is not ideal will demand direction. Education and birth control are realms where such control will be necessary. Propaganda and indoctrination will be used, even more than today, to induce cooperation. But, "neither science nor the technical applications which every society wants to utilize implies that one social organization, and only one, is bound to spread throughout the world."[5] The same applies to people, who will retain uniqueness and regional customs.

Its Ideas

For the past twenty-five years the world has been divided into three parts--the East, the West, and a "third world" composed of those underdeveloped areas which are not aligned with the other two.[6] However, in 1991 there will be only two identifiable blocs or groups of nations--the industrially developed one and the industrially developing one.[7] There will be some difference in their ways of life. The former will offer the individual more choices and opportunity for self development. The latter will be more monistic and rigid though discipline like that in Orwell's Oceana will not be required.

It is inevitable that the technical society will become the universal society. Economic, political, and social ideologies, world-wide, will be more similar in 1991 because of increased commerce and cultural diffusion and, even more important, because interests and needs will be similar. Religion will become more secularized. Moral standards will be more general. As one scientist prophesies: "Just as the doctrine of evolution became the doctrine of progress, so the information theory will become the doctrine of community formation, the theory of the certain control of the collectivist society."[8]

Its Things

With the application of cybernetics and all sciences the material wealth of the world will increase. With this increase there will be more equitable distribution. A relatively few have had adequate food, clothing,

---

[4] Not artifacts, perhaps, but some intellectual, aesthetic or social "product."

[5] Aron, World Technology and Human Destiny, p. 15.

[6] "Underdeveloped" in that there is a noticeable discrepancy between potential, and the actual harnessing of energy.

[7] "Developed" or "developing," cybernetically, as well as in the sense above.

[8] Riessen, The Society of the Future, p. 155.

health, and housing but Bellamy's analogy of large sidewalk canopies to replace individual umbrellas will be applied to private property of all kinds. With less bequeathed, by persons, to their own progeny, and more held in trust, by society, for man in general, will come greater consideration for resources.

There will be a continuing trend toward bigness, centralization, and planning. An elite of expert leaders and administrators will be discernible, their basis of authority being knowledge and judgment.

Cybernation will accent control. Individuals will be less able to outwit the system, and machines will be less likely to break down, because information about their behavior and operation will be more complete. Conversely, the system will be less able to outwit man. He will be able to control the weather. He will have begun to accelerate or retard the growth cycles of plants and animals according to his requirements. He will use the resources of oceans. Synthetic foods and fuels will be producable at will.

Cybernation will accent communication. Individuals will have more commerce with distant lands and people, both vicariously through international press and television, and actually by visiting and meeting visitors from distant places. All interaction will be more spontaneous. English will be modified to become a universal language. Transportation will be fast and safe. Air traffic will increase. A beginning will be made in submarine travel. Land transportation will see a renaissance especially through the use of speedy trains to link centers of activity in and between metropolitan areas. Personal modes of transportation will be smaller, and their traffic will be automatically regulated.

Travel to other planets will be technically possible in 1991 but not usual. And if the world is now waiting for some message from fellow beings "out there," it will still be waiting in 1991. Man in this century will continue to feel his way in the world, less by trial and error, perhaps, and more successfully, but still alone.

BIBLIOGRAPHY

Aron, Raymond, ed. World Technology and Human Destiny. Ann Arbor: University of Michigan Press, 1963.

Baade, Fritz. The Race to the Year 2000. Garden City, New York: Doubleday and Co., Inc., 1962.

Barich, Arnold B., ed. 1975 and the Changes to Come. New York: Harper and Brothers, 1962.

Bellamy, Edward. Looking Backward. New York: New American Library (Signet Edition), 1962.

Huxley, Aldous. Brave New World. New York: Bantam Books, Inc., 1960.

Orwell, George. 1984. New York: New American Library (Signet Edition), 1964.

Polak, Fred L. The Image of the Future. New York: Oceana Publications, 1961.

Riessen, H. van. The Society of the Future. Philadelphia: Presbyterian and Reformed Publishing Co., 1952.

Rodwin, Lloyd. The Future Metropolis. New York: George Braziller, 1961.

Scheler, Max. "Man in an Age of Adjustment," in Varieties of Classic Social Theory, Hendrik Ruitenbeck, ed. New York: E. P. Dutton and Co., Inc., 1963.

P. L. Herold
Engineering 100
January 3, 1967

BATMAN COMES TO SAL SI PUEDES

A short distance from Highway 101 in East San Jose is an area known by its residents as "Sal Si Puedes." Translated, "Sal si puedes" means "get out if you can." The denotations and connotations of "get out" are more complex than they might initially appear to be.

In her book on this area of San Jose, Margaret Clark has authoritatively traced the origins of the term "Sal si puedes."[1] According to Miss Clark, "get out" is to be interpreted from its literal denotation: "get your car out of the mud if you can." This usage arose from the prevalence of grossly inadequate (hence, in the winter, mud-ridden) street and driveway surfacing in this area.

By the most elementary extension into connotation, we would infer that if you can't get your car out of the mud, then you are stuck. And when you are thus "stuck," the readily apparent alternative is to go inside and wait.

This is exactly what many of the residents of Sal Si Puedes do--they wait. They surround themselves with the objects of immediate gratification and "conspicuous decency."[2] Examples of conspicuous decency are color television sets, commercially advertised toys, and other consumable goods--particularly automobiles. There is a steadily replenished supply of things which make the people's stay in the quagmire more tolerable and partially comfortable.

So much of what is experienced as "comfort" or "resignation" is learned rather than innate--the starving person in India will die before attacking a sacred cow or overtly stealing from those who have food. But the man in Sal Si Puedes is not starving, and the economy does provide him with a certain number of things which he has learned to need as a prerequisite to being comfortable. In the end his stay in the area is not confined to periods of unusable driveways and streets.

What of those who do leave Sal Si Puedes? The Alum Rock Union School District microfilms the records of all leaving school children. The administrators know that a very large percentage of the families that leave will return and that the children will be re-registered in the very school from which they were withdrawn. Relatively few "get out"; the stay in Sal Si Puedes becomes permanent. Here, as in all too many depressed areas, there is a perpetuation of deprivation.

It would be futile to attempt in a short paper to explain the perpetuation of deprivation. Volumes have been written on the subject without uncovering an adequate explanation. Arguments have ranged from those of Ricardo and the "iron law of wages" to Marx's counter-claim that inherent in the emergence and conflict of social classes is a great leveling and synthesizing force.

---

[1] Margaret Clark, Health in a Mexican-American Community, Chap. 1.

[2] Thorstein Veblen, Theory of the Leisure Class, p. 141.

The discussion of the present paper adheres more closely to a Ricardo-like argument. More specifically, the relationship between cybernetics and depressed areas will be evaluated from the standpoint of the following statements:

1. The perpetuation of deprivation, in so far as it exists, is due at least in part to a conservative (as opposed to an openly rebellious or radically changing) social climate.

2. Members of the upper class and, to a limited extent, of the middle class utilize the control and ownership of technology and industry to entrench themselves more firmly in a position of security and privilege.

These propositions hinge on assumptions found more explicitly in the writings of Thorstein Veblen than those of David Ricardo. Veblen argued that

> the office of the leisure class in social evolution is to retard the movement and to conserve what is obsolescent. . . . They are not required under penalty of forfeiture to change their habits of life and their theoretical views of the external world to suit the demands of an altered industrial technique [such as automation and cybernation].[3]
>
> . . . The usages, actions, and views of the well-to-do leisure class acquire the character of a prescriptive canon of conduct for the rest of society . . . by virtue of its high position as the avatar of good form, the wealthier class comes to exert a retarding influence upon social development far in excess of that which the simple numerical strength of the class would assign it.[4]

Furthermore, argues Veblen, the abjectly poor dwell so thoroughly on arranging for the immediate that a futuristic orientation is excluded almost by definition. Add to this the tendency of the lower classes to divert what disposable income they do have to the essentially frivolous expenditures required for conspicuous decency, it follows that "the outcome of the whole is a strengthening of the general conservative attitude of the community."[5]

Unlike Veblen, Marx underestimated the subtle nature of the controls exercised by the wealthier classes over the lower classes. People who have less admire as models those who have more. Advertising is based almost exclusively on the premise that consumers seek to identify with successful people. Packard advertised its luxury car by depicting a wealthy man in his plush living room; beneath the picture was the sole caption "Ask the man who owns one." In Sal Si Puedes the people are interested less in a classless society than they are in patterning their income-disposing behavior in a manner that approximates the socio-culturally sanctioned prescription set by the successful classes.

---

[3] *Ibid.*, p. 137.

[4] *Ibid.*, p. 138.

[5] *Ibid.*, p. 141.

As long as deprived families are thus "cooperating" with the system, they are not acquiring equity. Not the least important advantage that accrues to the members of the wealthier class is their option to invest surplus of disposable income. In fact, the upper class acquires equity in its conspicuous consumption (disposable capital, such as housing) while the largely renting lower class acquires perishable and depreciating goods.

By virtue of acquiring equity, members of the upper class become the decision makers. It is rumored that the decisions of one hundred men run the American economy. What, it is objected, of the millions of stockholders? They are notoriously mute as long as the company is making money. It is to this very end that the shareholders have invested that portion of their income which they chose not to spend in other ways.

The question is not whether this disparity between power and decision making status exists between the higher and the lower socio-economic classes. The disparity does exist. It might more profitably be asked why cybernetics is not being utilized to interpret the authentically human needs of all people, irrespective of socio-economic class membership, and to efficiently program American industry to fill these needs.

Veblen had an answer for this question: "Institutions are products of the past process, are adapted to past circumstances, and are therefore never in full accord with the requirements of the present."[6] The problem of cybernetics as related to depressed areas centers on the adoption and control of cybernetics by present institutions whose current policies and leadership are anachronistic.

Partly as corollaries to the initial two statements (see above), the following arguments are advanced:

1. Cybernetics, as both the knowledge and technology of information processing/decision making, is controlled by those relatively few men who, by virtue of their position, make decisions that function within limits to regulate the economy.

2. The avowed purpose and intention of these men, and of American enterprise as a whole, is to make money and to establish/maintain privilege. To this end, cybernated and automated systems will be utilized to analyze and supply (information utilization) markets with an eye to filling authentic human needs only in so far as the fulfilling of such needs does not precipitate a profit imbalance. If the latter should occur, industry will create/synthesize a need or needs through its knowledge and control of communication media (lobbying, television) and fill that need at a profit. Benefit to

---

[6] Ibid., p. 133.

the depressed socio-economic classes is only coincidental with industry's use of cybernetics.

3. The "good life" is mirrored everywhere. All available communication media serve to sanction the pursuit of symbols of the good life. Concurrently, members of the lower classes expend ever more of their disposable income on depreciating goods rather than redirecting this income in appreciating capital investment (equity or common corporate ownership).

4. This essentially "wasteful" expenditure by lower-class people is realized partly as corporate profit which:

   a. Ultimately further entrenches those who control and share such profit, and

   b. Strengthens the prescriptive function of the privileged (people emulate Henry Ford's daughter as the "best dressed woman"; youngsters of all ages pattern important purchases according to the "Beattle-oriented" style, in addition to buying their records--all of which contributes to larger circulation of their subsequent records and thereby the extensiveness of their popularity).

Ideally cybernetics would be employed to eliminate privilege and bias (error) in the evaluation and filling of need. Are we moving in the direction of the ideal? To the extent that the four above statements are true, we would predict that cybernetics, as well as the technologies of cybernation and automation, are being used by those in control to attain ends that, if not outrightly outdated, are socio-culturally disfunctional.

To walk down the streets of Sal Si Puedes, one would readily come to the conclusion that the above prediction is verified in fact. Instead of giving careful attention to appropriate dress and diet, many of the people of Sal Si Puedes cut every possible corner to obtain the socially-sanctioned and prized television and automobile. Shoeless, the children run up and down unpaved driveways trailing Batman capes. Many families go without adequate bedding but do not go without pop records. Always to be seen in the pictures taken with the one-minute developing camera from Payless are the woefully neglected teeth of child and adult alike.

The science of cybernetics is not being used to adapt the output of American industry to the genuinely human needs of all socio-economic classes. At unprecedented rates, the technology of cybernation and automation is being utilized to synthesize and supply needs that serve to perpetuate rather than eradicate deprivation.

In the midst of it all, the people of Sal Si Puedes wait. Ten minutes away is the San Jose State College Computer Lab; fifteen minutes away via Highway 101 is the South San Jose IBM plant. Perhaps either or both of these facilities will help raise the people of Sal Si Puedes to a level that approximates fulfillment and dignity. Until such time, the efficient marketing of Batman capes, Beatles' albums, and even color televisions conspires to placate those who, in the end, have so little.

From Manhattan to Sal Si Puedes covers a long period of this nation's history. One wonders how long the country will be able to postpone its human responsibilities by distributing trinkets.

In the face of the Third Industrial Revolution, it is time for cybernetics to cease being a problem for depressed areas; it is time to direct cybernetics and our growing industrial technology to the long-awaited eradication of such social injustices as prolonged poverty and unwarranted privilege.

Martha McCarthy
Engineering 100
May 19, 1966

THE PROBLEM OF APPALACHIA

What is wrong with Appalachia? In the first place, most of it is made up of inferior dirt. It is full of rocks, it is either sour or clayey, and it runs up and down so you have to get from A to B by way of E, and doesn't contain anything that can't be used better somewhere else. In the second place, the people have made the worst of what they have, cutting the trees, causing erosion, depleting the soil, raping the land with strip mines, and polluting that beautiful water by dumping in it, peeing in it, and filling it with chemicals until it's a toss-up, if you go wading, whether you'll get typhoid or metal poisoning. In the third place, the attitude of the people in Appalachia is filled with suspicion, resentment, hopelessness, and violence, often for good reason. Because of the country, they are frequently living in isolated groups and defy useful generalization. In the fourth place, the attitude of outsiders toward Appalachia is filled with suspicion, resentment, false optimism, and a patronizing disregard of the opinions of the backward natives. All you can do is get the people out of the place, and they don't want to go. Perhaps they are right. It was the problems of the new influx of poor southern whites that caused a Chicago colored social worker to say, "First time in my life I ever felt better off than a WASP."

What is being done in Appalachia? Well, there's the Appalachian Bill. It's intended to "create islands of prosperity, connected by roads that can pull people out of the hollows, into productive work." Also to "pave the way for more tourist travel in the mountains of the region." That is, get the poor out of the hills into new factory towns and get the "rich" in. But the hills are pretty and the towns are ugly *and* obsolete before they're built. Why not be miserable at home? Because if these people starve to death in the midst of plenty, our system, our way-of-life, will obviously have failed, and our system has always held that a job is the answer to everything. Do you need money and self-respect? Get a job. There aren't any here? Then get up and go! Appalachia is 50 years behind the times. By 1980, it will be only 15 years behind the times. Isn't that wonderful? Besides, if you just let them fester up in the hills, they're going to be different, out-of-step, deviant. They should be like *us*. These people need jobs.

Like Hell they do. First things first. They need what a job is a means to. They need the necessities and self-respect. Roads are a good thing, and badly needed, but food, Enovid, schools, and doctors are needed more.

So look. We don't know what to do there. We don't know that the Appalachian Bill will work. We merely hope that it will help. *Anything* we do will be an experiment, no matter how conservative it sounds. Let's admit it. In fact, any conservative unified plan is apt to fail, simply because the situation is desperate and complex. West Virginia, Alabama, and Ohio are very different states with different problems. Alabama has always been poor--but Ohio and New York? That lovely industrial society we're trying to encourage has already slapped them down. They had it, and it left them high and dry. Why should a industry settle in Appalachia? Location? Resources? Skilled manpower pool? And if a few more factories are attracted, so what? New York City is, surely, an "island of prosperity" with roads leading into it? (One thing about Appalachia, it doesn't use much heroin.) Yet New York State has counties eligible under the act.

I suggest two simultaneous strategies, or experiments. Conservative strategy in most states, roads, retraining, attracting industry, not just one plan, but a group of plans suited to the section, flat farmland or hilly country or whatever. The new strategy in West Virginia, the only state that is entirely within the Appalachian area. There, the negative income tax, and do-it-yourself training.

Except for West Virginia, let the Appalachian Bill prevail, and its intentions be implemented. I believe that it is inadequate, a sound businessman's plan, but short-sighted. It should be supplemented by aid to children, and food distribution. I will not discuss the Bill further, except to say that it misses the point a little. But I don't know, and neither does anyone else. By all means, try it. There is no political way I know of to avoid it. Though if you restore the soil to what it was, it never was commercially valuable, and a mill town is always awful, and they'll still have babies.

West Virginia is a valuable chance to try to go ahead, rather than to try to catch up. It is in such awful shape that (1) no one believes that the conventional measures will really work, and (2) fewer would protest the use of radical measures, and (3) results would show up. Since it is all poor, our radical measures could be used more efficiently. And the negative income tax isn't really as far-out as all that--Thomas J. Watson of IBM is not a Commie--but there are still some people not resigned to TVA.

If the negative income tax were statewide--all state money now going to relief, ADC, unemployment, etc.--and the checking and bookkeeping for these could be applied to it. This tax money would be a right, not a dole, and, so near as is possible in society today, would not decrease self-respect. I would suggest one modification--less than the amount of pay would be deducted if a man was employed, and making less than the minimum. This would mean that a man with a crummy job would not be working for nothing. This money would be spent in the state. The poorest would buy things rather than be given surplus from outside. This would help the economy immediately, and just as much in the hills as in the slums. Human prosperity would reach those it is said to be intended for at the start, and then radiate outward. You might call it the trickle up theory.

Erosion and pollution control would remain important. Water pollution must be cleared up as a health matter. Health centers could be set up in West Virginia on the same plan used for the rest of Appalachia. Schooling in general should be aided, so that people would be more adequate, either to stay or to go. (And, if there's anything to stay for, who is most likely to know what it is, and encourage it?)

But retraining should, in general, concentrate on those who are staying. With a minimum income, and training in a building trade, a man, or a group of men, can build a house. It would not take all that much money to allow a native to live like a rich camper.

If a New York construction company builds the roads, West Virginia will have the roads, plus the money spent by the construction workers while in the state. If the construction company were subsidized to train as many machine operators as possible (not everyone on a road-building job is a highway engineer) it would take longer and cost more. But people who aren't hungry can wait longer, and West Virginia would have the roads, the money spent by the workers, the money earned by the local workers, a group of men who can work on more roads, and perhaps some pride in the road.

Appalachia must be subsidized to have the same standard of living as the rest of the country, or anything near it. But it need not be a bad imitation of the rest of our society for this reason. A good rule-of-thumb for survival, biological, industrial, or social, is Diversify. A bad imitation achieves nothing. And even if this plan fails miserably, Appalachia would be a part of the future in trying it out. It might be a very welcome change from being a decadent remnant.

P. L. Herold
Engineering 100
November 21, 1966

THE KNOWSE REPORT

"If I may have your attention, gentle---ah, Fred, Jack, could you come on in here and sit down? Now, gentlemen, I want to thank you for interrupting your day, but I assure you that it is completely necessary. I have avoided a night meeting to prevent your families from becoming suspicious."

"Oh really, George, one would think that you're really serious about that pile of rubbish or rubble or whatever it is. Spare us the frills and just tell us what they found."

"Fred, what would you say if I were to tell you that our world will never be the same?"

"So? It never has been."

"Well, let me come at you this way. I know you will think that there are easy answers to the questions I am going to ask you, but answer them for me anyway."

"I'll do my best."

"Fine. Now, where did we come from?"

"Well, I was synthesizing a new chemical. Hal, there, was . . ."

"No, no. That's not what I meant at all. Where did we, our people, come from?"

"From the sun, of course."

"Of course, the sun. But apart from the source of energy, why does our structure and behavior take the form it does?"

"From the synthesized chemicals that are injected into the blood streams during the fetal period."

"Such that we are different from the other animals?"

"Yes. They, of course, have been modified from their 'original' structure, whatever that might have been, by our chemicals."

"But will we be able to resolve the animal-man dichotomy eventually?"

"I believe so. It's really just a matter of further experimentation. When we synthesize the right chemical we will probably be able to produce an animal that greatly resembles ourselves."

"Except in one vitally important respect."

"No, as much as I hate to admit it, there would be no fundamental difference. We could, and certainly will, create an identifying mark so that we will be able to recognize our own."

"Ah! I think you're on the track I want. Now, Fred, why is it so important to you that the distinction be maintained?"

"Come, now, George! We not only create the animals, but we create our coming generations. Certainly you aren't suggesting that an animal, regardless of what chemical we give him, can do that."

"Do what?"

"Create his own kind. But we do both, even given that all forms of life ultimately derive from the same energy source and are modified as we judge fit with the use of our synthesized chemicals. An animal, even if it resembled us in structure and elementary behavior patterns, couldn't even synthesize a new chemical, much less determine the need for such a chemical."

"So you're saying that we are unique in the realm of life, regardless of how much other life-forms may happen to resemble us. And this is even more the case since we, with the knowledge to determine what chemical is needed and then synthesize it, create the similarities between us and other animals."

"Exactly."

"It sounds, Fred, like you take no small amount of pride in this difference between the animals and us."

"Right again. We are the ones who rose out of the random fusion of heat, matter, and energy and made all living things, including what we are today. This is the justification for our using all of the world for our ends. If we were not unique in our mentality, what right would we have to modify all other life forms?"

"What right, indeed? That is why I called you here this afternoon. You will very soon know why I insist on complete secrecy. I don't have to tell you, Fred, or any of the rest of you, what would happen if our certainty regarding our place in nature were questioned. Could our civilization live with such a doubt? Our entire justification for ruling, modifying, creating, synthesizing, life--all of this rests on our assurance that we have every right in the universe to do so. Enough said. I will let Dr. Knowse take over at this point. I think most of you have seen the name on research retrieval printouts. Dr. Knowse, if you will."

"Thank you, George. And thank you for your introduction. I hope it will help all of you gentlemen to appreciate how serious an innocent venture has become. I will start from the beginning. Some time ago our field workers detected on their meters an unusual density of primitive building materials. As you know, such a reading does not always indicate the presence of a buried city. We were encouraged, however, and began digging. The findings were very typical. Like all of the cities we have found, the buildings had been destroyed--but not by aging. An external energy source of frightful intensity had destroyed all of the area. As I say, nothing unusual about this finding. Nothing, unusual, at all, in fact, until we discovered a room far beneath the city. Even after this much aging, the walls were so strong that we required twenty-five days to break into it. The room contained tons of documents. We have been working for the last two years on decoding the documents, and we have finally broken the code. I want to make this much clear from the beginning: there can be no question about the translation. Please do not challenge the report in the future on the grounds that the translation is not adequate."

"What makes you think we will be tempted to question your report, Dr. Knowse?"

"That will become clear soon enough."

"I hope you're not going to report on all of the documents you found."

"No. I will report on the minutes of a 'Cabinet' meeting."

"A 'Cabinet'?"

"Yes. This seems to have been some ruling body. We judge from the transcript that about ten men, maybe two or three more, were involved."

"By 'ruling body' I hope you don't mean . . . ?"

"No, I don't. Apparently these men made the important decisions and the rest of the people abided by them. It may have been a good deal more complicated than this. When we finish interpreting our translations, we will have a much better idea."

"What's so different about the people abiding by the decisions?"

"Just this: the decisions were not mathematical."

"Not mathematical? How did they arrive at alternatives and solutions?"

"By talking, by thinking out problems together."

"What about error? Did this small body of men suppose that they could retrieve all relevant information in making decisions?"

"For the present, let's settle for this kind of picture. In our society the information machinery is continuously updated by all researchers in all fields. A continuous program evaluates this data and arrives at a probable course of action, including desirable alternatives, for the community. In this older society the men not only executed the decision, they made it. The problem then, as well as now, was revising the program when the machine would not smoothly 'take' the updating. So you see, their bewilderment at what to do with an unprecedented situation somewhat resembles our uncertainty in the face of the same obstacles."

"Except that our uncertainty is expressed within mathematical limits, which in turn restricts the range of values that can be plugged in."

"Quite so. I'll be interested to see if our system can handle the problem that my evidence will pose."

"Are you suggesting that *our* system . . . ?"

"I'm not suggesting anything, I won't have to. But let me get on with the report. The thing pretty much centers around the speech of a man called the 'Minister of Culture.'"

CABINET TO THE PRESIDENT OF THE UNITED STATES OF AMERICA
MINUTES OF THE PROCEDINGS
MARCH 31, 1997

Minister of Culture: Mr. President and fellow Cabinet members. I have been sitting here today and thinking much the same as I have been the last five years. During that period of time each of us has pointed to vexing problems. Others of us, in turn, has expressed this or that mandate and this or that solution. Nothing changed--that is, nothing but the society. It was in trouble five years ago. Today it borders on anarchy, revolution, or foreign control. And so I will share with you a question that has been troubling me: Is rational intervention totally futile?

Now, before you search for excuses and explanations, let me introduce a rhetorical game. No time for games, you will say. I agree. But this game has an object. In this game I will be a visiting critic of the Sixties. All of you will attempt to handle my objections. I will leave the room and then come bursting in as if I had just completed an inspection tour. (Exit)

(Enter) Mr. President! *Mr. President*! What have you bunglers done with our great country? Everywhere I have seen the same things--civilian uprisings, discontent, lethargy! Men and women roam the streets. People threaten to destroy machines and factories.

Mr. President: We'll thank *you* not to criticize *us*! It was your machines that lead to this damned abundance! to this needless leisure! The people need to be needed. They are not needed in the world of your machines and they know it. They are tired of what we leaders can offer them.

Minister of Culture: Well, they can read, can't they? The experience of learning and creating is a noble activity for leisure time.

Minister of Education: But sir, there are no books. Large communities dwell in the buildings you wasted for the storing of books. As objects, books are very wasteful. Mass information storage and retrieval allows central coordination. Specific research problems are suggested by the information-deficiency indicator. The research is performed, the data reported and stored. But we just can't have *everybody* deciding what action is indicated. Besides, individuals can't hope to retain the bulk of knowledge. What people can retain is obsolete and miniscule. Books can't update people fast enough. If nothing else, the books have been very useful in the synthesis of carbon compounds.

Minister of Culture: Athletics, then. If they can't exercise their brains, they can exercise their bodies.

Minister of Domestic Affairs: That lasted about a year. Then we found out that people loved to be spectators. They loved to witness, as well as create, heroes. When everyone participates there is no hero element. Athletics became routine and socially undesirable. Then, too, there simply wasn't enough room. Skiing takes up valuable residential land. Boating is fine, but there isn't enough room. Hunting? Fishing? There's no place in our automated community-food-processing for preparing game animals.

Minister of Culture: Movies, then! We used to love movies!

Minister of Domestic Affairs: What is there to comment upon? Our young people don't believe in love. Sex is so commonplace that we are equipping buildings with sexrooms as well as with bathrooms. Hardly a subject for artistic expression. Besides, computer-made telefeelies are quite popular. No one is interested in the old movies. And they're getting tired of telefeelies.

Minister of Culture: Then condition them, damn it! Surely the psychology of the Sixties was not so entirely irrelevant that you can't use some of it now.

Minister of Medicine: Ah, but sir! The kind of conditioning you're calling for has to be started with a young organism. By the time our conditionable children are grown, their parents may have destroyed that for which the children had been conditioned. No, if you had wanted conditioning, it should have been started in the Sixties. This isn't hindsight. The people knew the restrictions then just as much as we know them now. On the conscious level they found the prospect of conditioned children to be unpalatable.

Minister of Culture: Now, we could go on and on with this. For everything I suggested, you would tell me why it couldn't be. So, you say, what is the point of all this rhetoric? Just this. In the face of our present day problems, none of your solutions--none of our solutions--have worked. They have failed because they are answers from the 1960's for questions belonging to that decade. Our approach is thirty years outdated. But are we to blame ourselves?

To this question I give an emphatic No! It might be different had the intellectuals and teachers of the 50's and 60's come to grips with the problems their generation had created. Since they didn't, it's not surprising that they couldn't equip us with an ability to deal with these problems.

We might look upon our fathers and grandfathers as farmers. They mixed inventiveness, design, and mechanics to produce and germinate a radically new plant. They knew that, once in the ground, the plant would sometime flower. They knew, too, that when grown the plant would be laden with a potent fruit. And what did they do to prepare us for this growing plant? They taught us how to operate the machinery used in harvesting traditional crops. We learned how and when to control the growth of these crops. We learned everything about them--how best to distribute them, how to anticipate the consequences of shortages and surpluses, how to maximize the utmost human usefulness. In short, we learned the refinements and the operations which our fathers had learned from their fathers.

And all this time the new plant, the new crop, had been growing furiously. But our teachers had their backs to it. Still sitting across the desk from us, they finished their lessons with various puritanical admonitions. More and more our eyes were staring at what the backs of their heads knew was there. And then, just in time, they slipped quietly and eternally into their graves. That generation of scientists and scholars meekly suspected that their creation would user in a new era. But--either by example or by word--they only taught us the traditionally successful means of dealing with man's inventions.

In this connection I would like to read a short passage to you. I was touring an underground museum last week and happened upon a collection of history books. One author's thoughts aptly summarize what I have been saying:

> The translation of values into terms of policy is historically conditioned and subject to all the imperfections of the historical process; and the application of policy to a particular historical situation is also closely involved in the understanding and acceptance of that situation. Well-meaning reformers who propound utopian solutions of political problems commonly fail to recognize how far self-interest has intruded into the formulation of their ideal in terms of policy, and how complicated are the historical issues involved in its application.*

When we come right down to it, gentlemen, we see that our values and plans for salvaging civilization are historically conditioned. And as much as you may object to my saying it, part of the trouble with our plans has been our self-interest. I'm going to offer a solution for saving our civilization. I am going to ask you to sacrifice your self-interests entirely. Before I offer my plan, let me review what I think are our only alternatives at this late hour.

Entropy is about to have its day. We can sit idly by and be spectators to the conclusion of civilization. I think that you will agree with me that such a course is unthinkable. Few, if any, of us are so historically conditioned to see abdication as the only alternative in a crisis.

---

*Edward H. Carr, The New Society. Boston: Beacon Press, 1963, p. 18.

My proposal is, frankly, a modest one. I advocate that we accelerate entropy. I hastily add this qualification: we time the inevitable end to meet specific conditions. Let me be more specific.

Let us say that by no later than time r our civilization, as we know it, will be at an end. Whether this comes from the impending Franco-Arabian attack, from enslavement of peoples, or from general revolution is immaterial. The end of Western Civilization is in sight, and it will occur at no later than at time r. I propose that we do not helplessly wait for time r. We need not do so. We should precipitate condition s at time q.

Minister of Education: And what is condition s?

Minister of Culture: Thermonuclear holocaust.

Minister of Defense: You can't mean it!

Minister of Culture: Which would you rather have, r or s?

Minister of Defense: Neither!

Minister of Culture: Well, yes, of course. But it is an inevitable certainty that we will have either r or s, or both. What I have to say may be tantamount to exposing the painful edge of reality. From the standpoint of our civilization, it makes no difference whether we get r or s. In either condition we lose the remaining vestiges of social organization, individual freedom and integrity.

Minister of Defense: Why don't we gas the Franco-Arabian Bloc?

Minister of Culture: Perhaps you had better review the potentials of our gas.

Minister of Defense: Glad to. You will recall that we have a gas which is totally effective. It's nothing new--we've had it for almost thirty years. The gas is composed of molecules which antagonize norephinephrine--the "rage biochemical." This same gas also results in reducing the firing in the reticular formation. The combined effect produces a most relaxed and cordial person. We have another gas which can be added to this. This gas effects an unusual stimulation of the "thirst center" in the hypothalamus. The person becomes very thirsty. In a sense the person or persons who control the water supply control the person. If we could get the first gas into the weather-control station of the Franco-Arabians, we could have exclusive control of the place and amount of rainfall. We would then administer the second gas and thereby acquire total control of the people. It's all very neat, very clean, and quite effective.

Minister of Culture: There are only two things wrong with your plan. For one, the Franco-Arabians know about this and are ready to retaliate with their chemo-receptor-detonating missiles. Even if we got the leaders, the missiles would fire from the change in the chemical environment. In that case our missiles would fire back and thus, right back to s. My second objection: even if we were able to pull off the gas attack, how could we say that we still have our civilization? Our own people, we, ourselves, would be put into a master-slave relationship. This is hardly what I would want to call the capstone of Western history. Besides, I wouldn't trust our own people as masters--at least given the present condition. Even if we started conditioning responsible and humane leaders, they wouldn't be ready for twenty years. By that time I don't think any slaves would be alive.

Minister of Transportation: I hate to suggest this, but it is better than r or s. How about gassing the Franco-Arabians and our own people?

Minister of Culture: I've thought of that myself, but it still comes out looking pretty much like r. We still have the death of our civilization.

Minister of Education: Why not have a small body of leaders keep the people gassed while the children are being conditioned? Then twenty years from now we could turn off the gas and turn our adequately prepared citizens loose in our cybernated world.

Minister of Culture: A noble gesture, but who are we to select as the interim rulers? History has given us every indication that they would tamper with the child-conditioning to suit their ends. In the meantime they have a virtual certainty of a slave class and control of the world. I'm afraid the risks are too great here. Civilization needs better odds.

Minister of Medicine: All right, then, tell us more about q.

Minister of Culture: I'll be happy to. At time q, which we are to determine, we start the thermonuclear holocaust. It is imperative that every human being be killed. Perhaps a few could survive--as long as they were the same sex. To this end we must count on the missiles of the enemy and all of the enemies of the Franco-Arabians. None of our missiles must hit enemy missile sites.

Minister of Medicine: You call that saving civilization!

Minister of Culture: As strange as it sounds, I do. Who, sir, or what, will survive such a blast?

Minister of Medicine: The cockroach! Yes, the cockroach! A fine job he'd do in perpetuating the civilization.

Minister of Culture: A much finer job than you might suspect. My assistants have prepared fifty million of the little things.

Minister of Medicine: Sir, I find this insulting and not a bit funny!

Minister of Culture: I ask your indulgence. These cockroaches have been, as I said, prepared. They are quite special, let me assure you. Their RNA and DNA molecules, you see, have been programmed by the bioelectronic computer. The result is this: As a function of minimal atmospheric changes, certain mutations will systematically take place. Certain of these atmospheric changes are virtually assured by virtue of the holocause and its long-range after-effects.

Minister of Medicine: Granted it might work. And I suppose it would work, for all that. Damn! What a comment upon our times! Man prehistorically emerges from the mud, ultimately triumphs over nature by freeing himself from it, only to slink down into the mud of his own creation. Replaced by a cockroach.

Minister of Culture: Not quite. The mutations are programmed such that what we know today as the cockroach will, through time, more and more closely approximate the human being.

Mr. President: Oh, by Data! Do you mean that man will return to earth, descended from the lowly cockroach?

Minister of Culture: Not exactly, sir. He won't return to earth simply because he didn't leave it. And man won't be descended from the cockroach anymore than you or I are descended from the original oxygen molecule. We have programmed ourselves into the RNA and DNA molecules of this little organism. The cockroach is the agent through which man's form and heritage, and ultimately, Western Civilization, is expressed. The only point I haven't mentioned concerns the changing atmosphere. This works by simple feedback. In strategic locations we place large deposits of intensely strong chemical and radiation concetrations. As the atmosphere changes from the atrophying effects of the holocaust, one of these "mutation banks" senses the change and triggers a release of chemicals and radiations into the atmosphere. A mutation occurs in the cockroach--or whatever species he happens to be at the time. The effect of this chemical-radiation release atrophies at a predetermined rate. When the atmosphere reaches a new point, another triggering occurs followed by a new mutation. The upshot is this: We can have our civilization and our bomb at the same time. We can solve the dilemma perpetrated upon us by a technology which flowered in an intellectual vacuum. Now, I realize that this is a radical solution. But the problems we are facing are, we have agreed, most distressing. The future of Western Civilization depends on our judgment.

The arrangements have been completed. The cockroaches have been dispersed and the chemical deposits installed. I have taken the liberty of doing this. We can abandon the project at this point or go ahead. All that remains is our decision. If I may, Mr. President, I suggest that we adjourn for a couple of days in order to meditate.

Mr. President: So be it.

* * * * * * * * * * *

"Well, don't stop there, Knowse! What did they decide?"

"I'm afraid that I don't know."

"Don't know? Do you realize what you're saying? You threaten the framework and foundation of our world and then you dare to stand there and say 'I don't know'?"

"I can only tell you that after two months of searching, we have not found any evidence that the cabinet met after March 31, 1997."

"Do you mean . . . do I understand you to mean that we may be . . . may be nothing but cockroaches?"

"Yes. It's not certain, but it is possible. I think that you will now appreciate the secrecy surrounding our meeting. Yes, Fred, you had your hand raised."

"Sir, even if we are . . . even if we are that, I can think of worse things than having been created by peoples or things or whatever who were, for all that, intelligent enough to create us. And they seemed to be very responsible."

"But--supposing now that the cockroaches were released--did they do the right thing?"

"Who?"

"The men in the Cabinet. I mean, they were only men, themselves."

"How do you know that?"

"Sir?"

"What I mean is, who made them?"

APPENDIX IV

TYPICAL OUTLINES OF COURSE LECTURES

OUTLINE OF TOPICS

HISTORY OF MAN-MACHINE RELATIONSHIPS

I. Introduction

II. The Human Conditions

- A. Labor
- B. Work
- C. Action

III. The Ancient World

- A. Labor in Egypt
- B. Hero of Alexandria
- C. Technology and Science in Greece

IV. Beginnings of Science and Technology in the Renaissance

- A. Introduction of Arabic Numerals
- B. Roger Bacon
- C. Leonardo da Vinci
- D. The Clock

V. The Industrial Revolution

- A. Mechanization of the Textile Industry
  - 1. Kay's "Flying Shuttle"
  - 2. Hargreave's "Spinning Jenny"
  - 3. Richard Arkwright
- B. The Harnessing of Steam
  - 1. Savery's "Miner's Friend"
  - 2. Thomas Newcomen
  - 3. James Watt's Steam Engine
  - 4. Hard Times - The Luddites
- C. New Sources of Power

VI. Mass Production and Automation

- A. American System of Interchangeable Parts
- B. Eli Whitney
- C. Henry Ford

VII. The Thinking Machines

- A. The Closed-Loop
- B. Chronology of Computers
  - 1. Pascal and Liebniz
  - 2. Charles Babbage
  - 3. Hollerith
- C. The Modern Computers
  - 1. Symbolic Logic
  - 2. Post-War Developments
  - 3. The Age of Robots?

OUTLINE OF TOPICS

CYBERNETICS - CONTROL AND COMMUNICATION

I. Definition of Cybernetics

II. Control of Systems

  A. Need for control
  B. What is feedback?

    1. Closed-loop system
    2. Required conditions for feedback control
    3. Feedback in human systems

III. Mechanical and Industrial Systems

  A. Distinction between terms

    1. Mechanical systems
    2. Automatic systems
    3. Cybernated systems

IV. Control and Communication as Science

OUTLINE OF TOPICS

CYBERNETICS - CONTROL AND COMMUNICATION

I. Definition of Communication

- A. Communication in science and technology

II. Technical Communication

- A. What do we communicate?
- B. General meaning of technical information
  - 1. Examples of information transmission
- C. Basic elements of communications systems
- D. Historical bases for codes
  - 1. Phonetic writing
  - 2. First uses of redundancy
- E. The two-state code
- F. Early telegraphic transmission
  - 1. Intersymbol interference
  - 2. Noise

III. Beginnings of Information Theory

- A. Information Capacity of a system
  - 1. Selective vs. semantic information
  - 2. Binary digits (bits)
  - 3. Information rate (capacity)
- B. Information theory for probabilistic systems

IV. Contributions of Wiener and Shannon

- A. Uncertainty and entropy
  - 1. Definition of entropy
  - 2. Information vs. entropy

V. Significance of these concepts

- A. Relation to biology
- B. Relation to linguistics
- C. Information processing
- D. Semantics
- E. Pragmatics
- F. The Dilemma